

INTRODUCTORY.

MEDICAL RELATIONS WITH THE LAW COURTS.

"As a hunter tracks a wounded beast to its lair by its drops of blood, so let a King track [crime] to justice by close-searched proofs."—MANU'S LAW CODE (about 2nd c.B.).

MEDICAL Jurisprudence may be defined as the science which teaches us how to discover and apply medical and other scientific facts for the ends of law and justice.

The early use of medical knowledge for legal purposes can be traced in the ancient codes. Manu forbade corporal punishment of a pregnant woman; the Mosaic Law, which is now found to have been borrowed by the Jews from the Babylonian Code of Khammurabi (2123-2081 B.C.) and previous Aryan lawgivers, required the priests to adduce medical evidence in wounds, leprosy, etc.; the Greek forensics, such as Galen, discussed questions of legitimacy, simulated diseases, the differences between the lungs of the live-born and the fœtus; and for India there are similar references in the later *Vedas*, in Manu's code and the *Puranas*. In Vedic literature (circa 650-300 B.C.) abortion or 'the slaying of an embryo' (*bhrûnahatyâ*) was a specified crime.¹

It was not, however, until the sixteenth century A.D. that a definite status was accorded to medical evidence in courts of law. The peerage of the law was not drawn up in 1844 and a quarter of the century to the German emperor Ratisbon. In 1552 the name—*Constitutio* "the dawn of legal medicine." In it the magistrate is directed

¹ *Vedic Index*, Macdonell and Keith, 1912, I. 391.

to obtain the opinion of medical men in criminal trials where death was alleged to have occurred from criminal causes.

This new department of study was known as *State Medicine* in Germany, and as *Legal Medicine* in France, and when it was latterly introduced into Great Britain it was called *Medical Jurisprudence*, or *Forensic¹ Medicine*. The first systematic treatise on the subject in English appeared in 1787, in Dr. Parr's "*Elements of Medical Jurisprudence*," and in 1801 the first chair for the teaching of the subject was established in Britain, that of Dr. Duncan at Edinburgh.

Whilst the edifice of the new study was reared on the European continent, largely by the systematic labours of Orfila the Spaniard, of Tardieu in Paris, and of Casper in Berlin, before the year 1850 the classics of Christison of Edinburgh, and Taylor and Guy of London had redeemed the reputation of the British school, and soon thereafter India possessed Norman Chevers' pioneer manual. At the present day the importance of this subject is so well recognized that its study forms an essential part of the medical course of every university and licensing body in the United Kingdom. So also is it in India, for expert medical testimony, important in every country, is especially so in the East, where it is often the only trustworthy evidence on which hangs the liberty or the life of a human being.

In this way, the Law, in the interests of good government, often required medical men to assist it in laying bare the evidence of many kinds of crime and offences against the person and civil rights of individuals and the community at large, such as assault, murder, poisoning, rape, legitimacy, inheritance, divorce, insanity, fraudulent impersonation, questions of damages for injuries, life assurance, etc. Thus the medical practitioner is liable to be called on at any time to give evidence as a medical jurist in the witness-box, in cases of more or less public interest or notoriety, so it behoves him even for his own reputation that he should learn to look from the medico-legal standpoint upon all his cases which are likely to become the subject of judicial inquiry; and that he should carefully note down at the time everything likely to be of medico-legal importance.

It is also desirable that he should know something of the legal nature of evidence and the procedure in courts of law—and in the case of the medical jurist in India, the procedure in Indian law courts in particular, some of the

¹ 'Forensic' is derived from the Latin *forum*, the market-place, because the Romans, whose law code still remains to-day the basis of our own, held their court of justice there.

peculiarities of crime in India, the circumstances under which the more common crimes come to be perpetrated, and the devices ordinarily taken to conceal crime in this country.

Criminal Procedure and Medical Evidence in India.

The present law of India is based upon English and Roman law modified to suit the varying customs and religious beliefs of the Hindu, Mohammedan, and other different nationalities which make up the great Indian continent.

The preliminary inquiry into offences against the person and into sudden and unnatural deaths in India is made by a police-officer,¹ who is authorized in fatal cases to forward the dead body for examination to the nearest civil surgeon or other qualified medical man appointed by the Local Government to conduct such examinations, except in Calcutta and in Bombay city, where the coroner makes an inquest and arranges for the *post-mortem* examination. District, sub-divisional, and other magistrates specially empowered by the Local Government or by the district magistrate, may also hold inquests and order the exhumation of a body for examination.²

The medical officer's report is sent to the magistrate of the district (or his sub-divisional magistrate), who, in cases where a reasonable suspicion is established against an accused person in the case, may require the presence of the reporting medical officer to give a deposition at his court in presence of the accused and be cross-examined if necessary. For the medical report cannot be admitted as evidence until it has been deposed to and recorded *de novo* by the magistrate in presence of accused.

At this magistrate's court the medical officer should give

counsel with the evidence in the lower court laid before him and with weeks to pick holes in any loose expressions that he may have used, and prompted by a clever medical man at his elbow, may bring the medical evidence into discredit. On the other hand, if the medical report does not substantiate the charge, the case is not usually proceeded with further; for the medical officer exercises practically the judicial function of a 'Court of First Instance' in assault cases.

Should it prove to be one of the more grave offences, such

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The several criminal courts are: (a) High Courts; (b) Courts of Session; (c) Magistrates of the 1st class and Presidency Magistrates of the 2nd and 3rd class.

The powers of these courts are:—The High Courts and Courts of Session are empowered to try any offence and to pass any sentence authorized by law, but a sentence of death passed by a Court of Session shall be subject to confirmation by the High Court (s. 31). Courts of presidency magistrates and of magistrates of the first class may not try certain grave offences, e.g. unnatural offences, and may not sentence to imprisonment for more than two years; second class may not try any offence punishable with imprisonment (s. 29) for more than six months; third class may not try any offence punishable with imprisonment, and may not, for any single offence, sentence to imprisonment for more than one month and 50 rupees fine. Third class magistrates may not sentence to solitary confinement or to whipping, and second-class magistrates may only sentence to whipping, if specially empowered by the Local Government (s. 32).

A Jury is required in every criminal trial before a High Court. Juries are of two kinds, Special and Common. A special jury is composed of persons taken from a special list of about two hundred. In every case where the offence to be tried is punishable with death, and also in such other cases as a judge of the High Court may direct, the trial is to be before a special jury (s. 276). In all other cases the trial takes place before a common jury, i.e. composed of persons whose names appear in the general list of persons liable to serve as jurors.

Trials before a Court of Session are ordinarily conducted with the aid of assessors, two or more in number, but the Local Government can, by order in the official Gazette, direct trials before any Court of Session of all offences or any particular class of offences to be by jury. Section 320 of the Code enumerates the persons exempt from liability to

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Coroner's Court. This is a preliminary court of inquiry, into the cause of all accidental and sudden deaths, where there is any suspicion of foul play. In India the Coroner is restricted to the presidency towns, for the provinces the district and other magistrates are ex-officio coroners, although seldom performing the duties, the inquiry being conducted by the police in correspondence with the civil surgeon; see above. The coroner views the body at his inquest with a jury. At this court no accused need be present as no one is being tried, unlike a magistrate's court which is a court of inquiry, not into the mere cause of death, but into the culpability of a person accused of some specific criminal act or negligence¹ of a criminal kind, and where the accused must be present, and where witnesses may be cross-examined, and the simple cases be dealt with summarily.

At the coroner's court, however, any 'suspected person' must be present if possible, and has the right of producing witnesses, cross-examining himself or by counsel, and of making any defence or statement he desires. When a suspected person is ill the inquest is adjourned till he is able to attend. The coroner's court also inquires into the culpability of a person suspected, and returns a verdict specifying the offence of the suspected person, e.g. 'culpable homicide amounting to murder,' 'rash and negligent act,' etc. The coroner in India has the power to commit to the sessions direct.

In all cases of fatal accident and sudden and unexpected death under suspicious circumstances occurring in practice, the attending medical man should never grant a death-certificate when he cannot conscientiously certify the true cause of death, even should the family of the deceased press for a certificate to save the publicity of an inquest. It is his duty to report the matter to the police or the coroner direct; for afterwards if the magistrate or coroner be not satisfied that the death was from natural causes or simple accident they may have the body exhumed after burial, and if foul play be discovered make the

¹ Offence by 'illegal omission' (*Penal Code*, s. 32), e.g. a woman may be committed for murder by intentionally omitting to tie the cord, or to supply her infant with food (see chapter on 'Infanticide').

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medical man who wrongly certified an accessory to the crime. For instructions on the important question of *Death Certificates* see under that heading.

The Duties of a Coroner in India are thus defined: "Where a coroner has reason to believe that the death of any person has been caused by accident, homicide or suicide, or suddenly by means unknown, or that any person being a prisoner has died within the place for which the coroner shall inquire into the cause of death (1871), s. 8. Other provisions are: That an inquest need not be held in a case where a prisoner has died in prison from cholera or epidemic disease.—s. 9. That the coroner may order a body to be exhumed.—s. 11. That the inquiry is to be conducted by the aid of a jury (of 5, 7, 9, 11, 13, or 15 in number) who, with the coroner, are to view the body.—ss. 12, 15. The coroner is empowered to order a *post mortem* examination with or without analysis of the viscera, to be made by any medical witness summoned to attend the inquest, and such medical witness, other than the chemical examiner to Government, shall be entitled to such reasonable remuneration as the coroner thinks fit.—s. 18. Evidence is to be given on oath (s. 19) reduced to writing by the coroner (s. 20), and the jury are to return a verdict (s. 23). A coroner may appoint a deputy coroner to act for him when sick, or absent from any lawful or reasonable cause.—s. 28

Procedure in Courts.

To these courts the medical man is summoned to attend by a subpoena, and under a penalty. In civil cases the medical man is not to "conduct money," should be offered; and if this be not done the medical man may, in civil cases, previous to being sworn, refuse to give evidence till any reasonable fee demanded has been paid. But it is chiefly with regard to criminal cases that the medical man has to give evidence, and he has no option but to be sworn and examined irrespective of the question of fees.¹

When in cases of criminal law the medical witness is summoned to attend, he is not allowed to cross-examine the medical witness in the case, except on payment of the usual costs and

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When a civil surgeon or medical officer of Government, is called upon to make a post mortem examination, he is not to be paid a fee of Rs. 16 for the same. If he is called upon to give evidence in the case in court, he is not to be paid the usual costs and

compensation. The petitioner was convicted by an honorary magistrate of Narayanganj of causing hurt and was sentenced to six months' rigorous imprisonment and to a fine of Rs. 100 or, in default, six weeks' additional imprisonment. Their lordships made the rule absolute, holding that the petitioner was entitled, under s. 320 of the C.P.R., to cross-examine the witness without payment of costs or compensation (Calcutta High Court). *Englishman*, 23rd January, 1901.

On being called into the witness-box before your evidence is taken you have to be **sworn** (in accordance with the old Aryan custom of 'swearing' by making a vow to Thor and Odin (namely, the gods Brihaspati and Budh) upon a sword, from which the word 'swear' is derived). It is well for obvious reasons in taking the oath not to kiss the book, but to claim to be sworn by the more sumptuary Scotch form. For this hold up the right hand above your head, and say in a loud, firm tone: "I swear by Almighty God, as I shall answer to God at the last day of Judgment, that I will tell the truth, the whole truth, and nothing but the truth." Then your evidence will be taken.

Medical Evidence.

Every fact which is referred to in law must pass through the process of proof by testimony. How this testimony is elicited in India is detailed in the *Indian Evidence Act* (Act I. of 1872). Evidence is given in two forms: (1) documentary, or (2) oral.

Documentary evidence comprises all documents produced for the inspection of the court. For the medical jurist this comprises :—

1. **Certificates of death, ill-health, insanity, vaccination, etc.**—*Death certificates* must be given free of charge if the medical attendant knows the cause of death, even though his attendance fees have not been paid; he "must give a certificate to"

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Figure 1. The effect of the concentration of the *Agaricus bisporus* spores on the growth of *Agaricus bisporus* on the substrate.

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to obtain the opinion of medical men in criminal trials where death was alleged to have occurred from criminal causes.

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At this magistrate's court the medical officer should give his evidence with as much care as he would do in the High Court, for his evidence is recorded, and the case may go to the higher court however trivial it may seem, in which case the opposing counsel with the evidence in the lower court laid before him and with weeks to pick holes in any loose expressions that he may have used, and prompted by a clever medical man at his elbow, may bring the medical evidence into discredit. On the other hand, if the medical report does not substantiate the charge, the case is not usually proceeded with further; for the medical officer exercises practically the judicial function of a 'Court of First Instance' in assault cases.

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prisonment, and may not sentence to solitary confinement or to whipping, and second-class magistrates may only sentence to whipping, if specially empowered by the Local Government (s. 32).

A Jury is required in every criminal trial before a High Court. Juries are of two kinds, Special and Common. A special jury is composed of persons taken from a special list of about two hundred. In every case where the offence to be tried is punishable with death, and also in such other cases as a judge of the High Court may direct, the trial is to be before a special jury (s. 276). In all other cases the trial takes place before a common jury, i.e. composed of persons whose names appear in the general list of persons liable to serve as jurors.

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Coroner's Court.—This is a preliminary court of inquiry, into the cause of all accidental and sudden deaths, where there is any suspicion of foul play. In India the Coroner is restricted to the presidency towns, for the provinces the district and other magistrates are ex-officio coroners, although seldom performing the duties, the inquiry being conducted by the police in correspondence with the civil surgeon; see above. The coroner views the body at his inquest with a jury. At this court an accused need be present as no one is being tried, unlike a magistrate's court which is a court of inquiry, not into the cause of death, but into the culpability of a person accused of some specific criminal act or negligence of a criminal kind, and where the accused must be present, and where witnesses may be cross-examined, and the simple cases he dealt with summarily.

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serve as jurors or assessors, and clause (h) of this section includes among those exempted "surgeons and others who openly and constantly practise the medical profession."

When an accused person appears to be "of unsound mind, and consequently incapable of making his defence," the magistrate shall first inquire into or try the fact of such unsoundness of mind, and if this be proved the trial shall be postponed and the magistrates shall cause the accused to be examined by the civil surgeon, or such other medical officer as the Local Government directs.

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Procedure in Courts.

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Fees in cross-examination in criminal cases.—In support of a rule obtained on behalf of Iswar Chunder Ranth, calling upon the district magistrate of Dacca to show cause why the conviction and sentence passed on the petitioner should not be set aside and the trial resumed on the ground that the petitioner was not allowed to cross-examine the medical witness in the case, except on payment of the usual costs and

compensation. The petitioner was convicted by an honorary magistrate of Narayanganj of causing hurt and was sentenced to six months' rigorous imprisonment and to a fine of Rs. 100 or, in default, six weeks' additional imprisonment. Their lordships made the rule absolute, holding that the petitioner was entitled, under s. 350 of the C.P.D., to cross-examine the witness without payment of costs or compensation (Calcutta High Court).—*Inglishman*, 23rd January, 1900.

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Medical certificates must now be signed by registered medical practitioners in Bengal and other provinces where the register has been instituted.

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2. **Medico-legal Reports.**—These are the formal reports of an examination made by a medical man under a warrant from a magistrate, coroner, or authorized police officer in cases of assault, murder, etc.

These reports (see Form in Appendix III) should always be prepared with the utmost care, one of these may prove the death warrant of a murderer. The report should give (1) *Date and place of examination and name of witnesses*; (2) *External examination* (of living, pp. 31, 66, etc.; of dead, pp. 38, 74, etc.); (3) *Internal examination* giving the *opinion* giving the *history*. All the times, dates, and all articles submitted with a distinguishing number for reference, and the names noted of the officials or other persons from whom he received any articles, information, or who identified the person or body. Technical terms are to be carefully avoided unless their meaning is made clear.

The *opinion* based on the facts noted should be stated briefly and clearly, and given with the utmost caution (see pp. 71 and 98). For the apparent or alleged cause of injury or death is not always the real one; thus in India it is a common practice to hang up the dead body of a person who has been murdered so as to create a suspicion of suicide (see 'Hanging' in Chap. VII.), and there may be fatal concussion of the brain from a blow which cannot be ascertained by a *post mortem* inspection or dissection, but only inferred from the history of the case. If the medical attendant or registrar makes use of the history of the case, as supplied to him by the police or others, he should be careful to state this explicitly in his 'opinion,' e.g. "From the history of the case, and from the *post mortem* appearance, I am of opinion that the deceased died from shock caused by a blow";

ness or veracity of any such certificate, he may institute an inquiry, the result of which shall be reported to the Bengal Council of Medical Registration.

and where the opinion cannot be given until after the result of chemical analysis of the viscera is known, this should be stated accordingly.

Both of the above classes of documents require to be sworn to orally as true by the person who drew them up, in the more serious cases, but the following documentary evidence is accepted *without* oral evidence in court (1) Dying declarations, (2) Expert opinion from books.

1. Dying Declaration.

Statements, written or verbal, made by a person who is dead, as to the cause of his death or as to any of the circumstances of the transaction which resulted in his death, are admissible in cases where the cause of that person's death comes into question, no matter whether the person making such statement was or was not under expectation of death at the time of making it.—[*I. E. A.*, s. 32, and *Cr. P. C.*, s. 164.] If an injured person is likely to succumb, the doctor, failing the police, should arrange for the declaration to be made properly in the presence of a magistrate if possible, failing whom he may record the declaration himself.

The declaration should, if possible, be written by the person making it, otherwise it must be taken down in the identical words uttered by the dying man in his own vernacular, and nothing suggested or added. It should be read over to him and then, if possible, signed by him and attested by the writer, and any witnesses present. It should then be forwarded in a sealed envelope direct to the magistrate who would ordinarily inquire into the case.

At outlying dispensaries.—The hospital assistant in charge should at once call on the Sub-Deputy Collector or Tahsildār, or in his absence or when he has no magisterial power, the nearest honorary magistrate, to record the dying declarations of such persons as are likely to die and are in a fit state to make a statement. If there is, in his opinion, no time to call on the Tahsildār or an honorary magistrate, he may record the dying declaration himself.

The State of Mind of the declarant at the time when he made his declaration is of great importance.

It may here be noted that according to the law of England, the person making a dying declaration must not only be actually moribund, but must have no hope of recovery and believe recovery impossible.

2 Printed opinions of experts.

Expert opinion expressed in any treatise commonly offered for sale, and the grounds upon which such opinions are held, may be proved by the production of such treatises, if the author is dead, or cannot be found, or has become incapable of giving evidence, or cannot be called as a witness without an amount of delay or expense which the court regards as unreasonable.—*I. E. A., s. 60*

Case—An European, in a drinking bout at Calcutta, was found in his room, bleeding from a wound on the back of the head. A police-officer inquired, "How did this happen?" He replied, "Sho (his wife) threw a glass at me." The wife said, "Don't say that; you know I did not do it, he has fallen out of bed on a cup." The man was drunk, and

of blood on the brain was found, attributed to *contra-coup*, and the universal medical opinion was that the wife's statement was the true one, and that when the man accused her he was not mentally in a condition to know how the injury had been inflicted. A fall upon a tea-cup could produce the appearances described, whereas the power of a woman's arm would be insufficient to throw a tea-cup with such strength as to force the enamel under the pericranium. The wife was acquitted.—*Chevers, Manual Ind. Jurisp., 93.*

presence and by his direction. The testator must be conscious at the time when the witnesses attach their signature.

3. Evidence given in a previous judicial proceeding by a witness who is dead, or cannot be found, or is incapable of giving evidence, or is kept out of the way by the adverse party, or whose attendance cannot be obtained without an amount of delay or expense which the court, under the circumstances of the case, considers unreasonable, is admissible under certain conditions (* 33). Under this rule the deposition on oath of a dying person, taken by a magistrate in presence of the accused, becomes admissible in place of a dying declaration, and when the circumstances of the case permit, it is always advisable to take steps to obtain such a deposition.

4. Deposition of a civil surgeon or other medical witness, taken and attested by a magistrate in the presence of the accused, may be given in evidence in an inquiry or trial or other proceeding under the Code of

Criminal Procedure, although the deponent is not called as a witness, but the court may, if it thinks fit, summon and examine the deponent.—*Cr. P. C.*, s. 503.

5 Any Document purporting to be a report under the hand of any chemical examiner or assistant chemical examiner to Government, upon any matter or thing duly submitted to him for examination, or analysis and report, in the course of any proceeding under the Code of Criminal Procedure, may be used as evidence in any inquiry, trial, or other proceeding under the said Code—*C. P. C.*, s. 510.

Oral evidence must in all cases be direct, i.e. if it refers to a fact which could be seen, heard, or perceived in any other manner, it must be the evidence of a witness who says he saw, heard, or so perceived it, if it refers to an opinion, or the grounds on which that opinion is held, it must be the evidence of the person who holds that opinion on those grounds, and not mere hearsay.¹ Oral evidence is the more important of the two, as it admits of cross-questioning, so that the giver of documentary evidence is subject to be summoned for oral examination. If oral evidence refers to the existence or condition of any material thing, the court may require the production of such a thing for its inspection, viz. a blood-stained weapon, or article of clothing, a portion of eliminated poison, etc., etc. Hence such article should, always after examination, be preserved, if possible, for production before the court. 'Circumstantial' evidence attests one of the subsidiary circumstances of the case, e.g. in case of an alleged stabbing of A by B on a river-bank at 4 o'clock on a particular day, circumstantial evidence would be that I saw B with a knife in his hand at ten minutes to four on that day near that place.

Witnesses.

Evidence is of two kinds, namely, (1) '**Common,**' or testimony to facts which the ordinary witness has actually observed himself, and (2) '**Expert,**' or interpretation by skilled persons or specialists of the facts observed by others, or of recondite observations by themselves. The medical witness usually gives evidence of both kinds, but in nearly nine cases out of ten as an expert.

1. A '**common**' witness testifies to the facts. "Fact," as defined by the Indian Evidence Act, "means and includes (1) any thing, state of things, or relation of things capable of being perceived by the senses; (2) any mental condition of which any person is conscious." The medical man is a common witness

¹ *I. E. A.*, s. 60.

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when he testifies to the exact size and number of wounds, blood-stains, etc., of a wounded person he has examined, the exact weight of solids and volumes of fluids he refers to, the circumstances under which he found the body, any statement or confession made by the dying person, the actual cause of death, etc.

All persons are competent to testify, unless the court considers that they are prevented from understanding the questions put to them, or from giving rational answers to those questions, by tender years, extreme old age, disease, whether of body or mind, or any other cause of the same kind (*I. E. A.*, s. 118). In certain cases a witness may, on certain grounds, be excused from answering certain questions, e.g. —
to disclose communications made to him in official confidence when he considers that the public interests would suffer by the disclosure" (*ib.*, s. 124).

In addition to the provisions of the Penal Code relating to the giving of false evidence (ss. 191-195), and the publicity of judicial proceedings, there is the most

2. An 'expert' witness—This is defined¹ to be a person "specially skilled in foreign law, science or art, or in questions as to identity of hand-writing or finger-impressions"

Examples of expert evidence.—(a) "The question is whether the death of A was caused by poison. The opinions of experts as to the symptoms produced by the poison by which A is supposed to have died are relevant. (1) If it is proved that a certain act, was, . . . the nature of it was . . . contrary to law . . . symptoms exhibited by A commonly show unsoundness of mind, and whether such unsoundness of mind usually renders persons incapable of knowing the nature of the acts which they do, or of knowing that what they do is either wrong or contrary to law are relevant." —*I. E. A.*, s. 45.

Medical experts are skilled in such special branches as toxicology, obstetrics, insanity, etc., and also in the interpretation of wounds, etc., and when the medical witness is called on to answer questions of opinion either on the facts observed by himself or others, he becomes an expert witness, whilst the ordinary expert witness usually is asked merely for his opinion on certain facts of the case, and acts as an interpreter of facts without having personal knowledge of them. Previous personal knowledge of the facts of a case precludes a witness from

¹ *I. E. A.*, s. 45.

taking any possible advantage of the *status* of an expert¹ as regards compulsory attendance at court, &c.

Case—A medical man who has not seen a corpse which has been subjected to a *post mortem* examination, and who is called to corroborate the opinion of the medical man who made the examination and gave his opinion as to the cause of death is in the position of an expert.—*Queen Empress v. Meher Ali Mullick*, 13 Cal. 559.

The medical witness therefore must bear in mind this distinction between 'common' and 'expert' witnesses, and when stating facts of his observation, avoid giving opinions or inferences on these facts until asked to do so. It is, however, as an expert that he is mostly examined, and then it is a decision rather than evidence which the law demands of him when replying to such questions even in regard to facts observed by himself as—Is this wound dangerous to life? Was the wound accidental, suicidal, or homicidal? Was it inflicted before or after death? With what kind of weapon was it
 . . . be careful
 . . . and when
 . . . he should
 state his reasons for being unable to give a definite opinion on the point. Experts may refresh their memory by referring to professional treatises.² The apparently contradictory character of expert evidence sometimes is largely owing to the partisan manner in which it is elicited. The expert is often a party witness, each side being permitted to employ expert witnesses, and they are asked by their side to answer questions on the assumed facts which are most favourable to their side. Then in cross-examination the expert has to answer fresh hypothetical questions based on an altogether different combination of the assumed facts with the view of contradicting the original evidence.

Examination.

Your oral evidence is taken in the following order:—³

1. **Examination-in-chief.**—This is a series of questions put to you by the counsel for the side on which you appear, with the object of placing before the court in a clear manner all the principal facts you know that bear upon the case in point. He knows from his '*brief*' the nature of your evidence.

2. **Cross-examination.**—You are now subject to be questioned by the opposing counsel, with the object of weakening

¹ Manu, p. 9.

² I. E. A., s. 159.

³ *Ib. ss.* 137, 138 *et seq.*

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your evidence as far as possible, by trying to show how your details are inaccurate, conflicting, or contradictory. You must be prepared even for questions calculated to disparage your skill. Thus in a question of criminal abortion you might be asked. You are not an obstetric surgeon? How many cases of midwifery have you attended during the past year? In cross-examination 'leading questions,' i.e. questions which suggest the answer wished for or expected, may be asked; but if the question cannot be correctly answered in this way, you should inform the court accordingly, and in no case attempt to answer questions you do not clearly understand. Sometimes lawyers unfamiliar with medical science ask meaningless questions.

"Facts not otherwise relevant are relevant if they support or are inconsistent with the opinions of experts, when such opinions are relevant." *Illustration (a).*—The question is whether A was poisoned by a certain poison. The fact that other persons who were poisoned by that poison exhibited certain symptoms which experts affirm or deny to be symptoms of that poison are relevant.—*I E A*, s. 46.

3. Re-examination.—This is made by the counsel of your own side for the purpose of explaining apparent inaccuracies or discrepancies in your statements which may have been brought out by your cross-examination. No new matter may be introduced at this stage without the consent of the judge or the opposing counsel, and the opposing side may cross-examine on the fresh point. The judge and jury may question you at any stage to clear up ambiguous points. It often happens that the medical evidence is so little in dispute that no cross-examination is held.

Questions which may be asked.—For a list of many of these, see Appendix I, which should be carefully studied in detail, as several of them will almost certainly be asked.

Hints on Giving Evidence.

The medical witness should remember that he is not, and should not be, a partisan on either side. He has come to tell the truth, what he *knows* about the case, and not to elench the case against the prisoner. As he is not omniscient, he must not be ashamed to say, 'I do not know.' His evidence ought to impress the judge and jury, and, if he can, he should try to make his evidence a self-evident truth.

Notes in court.—All facts of medico-legal importance observed by you in a case should always be committed to

writing in your own hand, on the spot, or as soon after as possible, and such notes may be taken to the court to refresh your memory, provided permission of the court is obtained.¹ But as the evidence of a witness must be oral, as far as possible, you are not allowed to read out such notes, as evidence to the court.

"A witness may, while under examination, refresh his memory by referring to any writing made by himself at the time of the transaction

by reference to any document, he may, with the permission of the court, refer to a copy of such document: Provided the court be satisfied that there is sufficient reason for the non-production of the original. An expert may refresh his memory by reference to professional treatises" (*I. E. A.*, s. 159). Any writing used to refresh memory must be shown to the adverse party if required (*I. E. A.*, s. 161).

Speak slowly, loudly, and distinctly, to allow both judge and recorder to hear easily, and to make notes of what you say.

Use plain and simple language, avoiding technical terms which are not intelligible to non-medical persons, such as 'cicatrix,' 'contusion,' 'gastric mucous membrane,' 'pericardium,' 'ecchymosis,' 'traumatic,' etc.; employ instead 'scar,' 'bruise,' 'lining membrane of the stomach,' etc.

Avoid superlatives and exaggerations. Avoid such expressions as "there was an enormous bruise on plaintiff's shoulder, the blow must have been a savage one delivered with great violence," and that "the pupils were pin-points."

Be precise and concise. For example, be prepared to give the date and time of each event about which you have to give evidence, the exact measurement of wounds, the exact weight of solids, and volume of fluids, etc. Photographs should be utilized if available.

State facts only, not mere opinions, unless expressly asked for these latter. Thus, in the case of suicidal hanging, you should only certify to the fact of hanging, for whether it is suicidal, or homicidal, or accidental, is a matter of expert opinion or other evidence. Give your answers irrespective of the possible result on the trial.

Keep your temper during cross-examination. To lose it would convey the unfavourable impression to judge and jury

¹ *I. E. A.*, s. 159; *Niz. Ad. Rept.*, 4th April, 1851.

that you are hasty in forming conclusions and therefore untrustworthy. If compelled to answer 'Yes' or 'No' to a question in cross-examination when it would convey a false impression, qualify it by an explanation, and appeal to the judge if you think any question unfair.

Professional secrets.—In a court of law a medical adviser is bound, if asked, to disclose otherwise inviolable secrets, if not self-incriminating, which he may have had confided to him professionally by a patient, as in questions of legitimacy, venereal disease with reference to divorce, etc. If the medical attendant through conscientious scruples refuses to answer, he is liable to be committed for contempt of court. In such cases it is well for the medical man first to appeal to the judge for a ruling, claiming privilege to decline to give such secrets, so that if the judge still rules that it is necessary for you to speak, it will be evident to all that you divulge these secrets only under compulsion of the law of the land.

Lord Mansfield in 1776 put it very clearly—"If a surgeon was voluntarily to reveal secrets, to be sure he would be guilty of a breach of honour; but to give that information in a court of justice which by the law of the

Quotation from books.—You are not allowed to quote in your replies any books by an author who is alive, on the principle that evidence should be oral, and the giver of it should be present for cross-examination. Books are sometimes quoted in court by counsel, and the witness is asked whether he agrees with the quotation. In such cases the witness should, before replying, ask to be allowed to read it over himself, and see whether the context does not give it a different meaning from that assumed for it by the opposing counsel.

In giving an opinion in court be well prepared beforehand, by having considered the various points on which you are likely to be called upon to give an opinion, what inferences drawn from the facts would tend to support either side of the case. Consult the works of the leading authorities on these points; ascertain what opinions are therein expressed, and the grounds

on which such opinions are based, and frame your own opinions with due regard thereto. Be careful to draw no stronger inference and give no stronger opinion than the facts warrant. It frequently happens that the facts available do not justify a conclusive opinion being given one way or other: in such a case do not hesitate to state so, but be prepared to state precisely your reasons for being unable to give a definite opinion on the point.

Lying in Forensic Psychology.

Lying is one of the great difficulties with which the Medico-legal expert, in common with the Judge, has to grapple in Europe, and it is by no means less prevalent in India. Children, otherwise mentally sound, especially if their moral education has been defective, or they have been associated with liars, may occasionally tell a lie from motives of fear, or to gain some private desire, or screen a friend, at a period when they are not yet able to distinguish clearly between their desired ideal and the moral quality of the means employed to obtain it. But it is the adult liars who lie deliberately with the purpose to deceive, with whom we have seriously to deal, and for whom there is no such excuse, and who constitute a menace to society and civilization.

Habitual lying, to a greater or less extent, appears to be much more prevalent in civilized communities than is generally admitted, although only a relatively small proportion of the individuals who practise it find their way to the criminal or police courts. It inevitably tends in the direction of crime, and is associated usually with some physical defect in the brain, it is absent relatively or absolutely in the higher normal and well-balanced types of brain and intellect, to which lying in all its forms is repugnant; while it is notoriously prevalent in degenerates, imbeciles, and insanes. A common feature which the habitual liar shares with the feeble-minded, epileptic, hysterical, and insane, is that they are not a whit abashed at being found out. They are thus "Pathological Liars," in contradistinction to the "Occasional Normal Liar," who tells a lie occasionally to conceal some inconvenient truth, or it may be deliberately to get some person, against whom a spite is cherished, into trouble—a common motive both in India and in Europe. Between the habitual and occasional lying comes a third class, the "Fictional Liar," who tells a lie more or less than "fiction," and in war-time, who thus

The Pathological Liars, however, are seldom so completely diseased as to be altogether insensible to the difference between right and wrong, even when subject to hallucinations. They usually know their stories are false, but they wish they were true, and they hope by cunningly contrived plausibility that people may be deluded into accepting them as true. They are often extremely clever and personally attractive. Some enjoy success as swindlers, others have caused grief to their families by figuring in *causes célèbres* in which they accused their parents or guardians of the most abominable crime, weaving tales so plausible as to deceive the general public.

An interesting analysis of the antecedents and psychology of over sixty well-authenticated cases of such inveterate liars has recently been published by the Drs Healy,¹ which shows that invariably there has been some mental defect in the family, which may range from mere inability to resist alcohol up to actual insanity. The patient herself—for it is to the female sex that most pathological liars belong—generally has shown a tendency to excessive lying in childhood, in the years when character is forming. In some cases this may have been imitative in a home where some member of the family was notorious for the same position by "making believe." The influence of bad companions and sometimes a ready wit, leading to the opinion of others. Though prone volubly to embroider facts or invent interesting occurrences in which she plays a leading part, she is as a rule suggestible. Very often she runs away from home and is found by kind-hearted strangers to whom she tells a thrilling tale of how her parents beat her, till it dawns upon the philanthropist that he is harbouring an incorrigible liar; though on the other hand, owing to their innate cunning, they may never be found out and exposed." Such are the class who bring false charges of immoral assaults. Habitues to the abuse of alcohol, morphine, and cocaine are also especially addicted to lying to conceal and facilitate their vice, and may be classed as pathological liars, who tend in the direction of crime.

It is only by careful questioning, cross-questioning, and traps carried out at more than one interview, that one is likely to elicit the real facts and reconstruct the true case.

¹ *Pathological Lying, Accusation, and Swindling* By W. Healy, M.D., and Mary T. Healy, B.L. London, 1915

Special Difficulties in detecting Crime in India Medico-legally.

Some of the special difficulties in the way of the medical jurist in India getting at the truth in criminal cases are due to:—

- 1 Rapidity with which decomposition destroys dead bodies in the hot climate.
- 2 Facilities for concealing and destroying dead bodies, together with the general practice of rapid cremation or burial a few hours after death.
- 3 Insufficient particulars of crime in the police reports accompanying the alleged assaulted person or a decomposed dead body.
- 4 Untrustworthiness of so much native evidence, owing to the wide prevalence of false swearing and fabricating false charges.

1 **Rapid decomposition.**—This tends to obliterate the traces of the cause of death whilst rendering the autopsy very ty nevertheless is to per- possible. The despatch examination is often in country districts delayed in the hot weather for several hours with consequent loss of evidence, owing to the responsible official shrinking from contact with the dead body until evening or the next day, as contact with a corpse prevents a Hindu mixing with his family or friends until purified by more or less elaborate ceremonial bathing. For this reason, a fudged report may be sent in without the body having been inspected at all. When, as often happens, the body does not reach the medical officer for examination until several days after death, after having been carried scores of miles in the heat on men's shoulders, it is then in such a horrible putrid condition¹ as to make even an external inspection very trying, and detailed dissection useless. It is thus necessary that the police report accompanying the body should furnish the medical officer with sufficient particulars to indicate the direction in which he should pursue his search into the cause of death. Otherwise when decomposition has fully set in he cannot be expected to

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Report of the Medical Officer :

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throw much light on the cause of death. Nevertheless it is well never to refuse to make an examination even in such cases. For wounds inflicted during life can, for a considerable time, be distinguished in the dead body from those inflicted after death and from mere decomposition changes. Certain tissues, such as those of the uterus,¹ resist decomposition for a long time; certain poisons (such as arsenic) may persist for many months, fractures will be evident, though, if the decomposition is far advanced, it will be difficult to say whether the fracture occurred during life or not, and some important identification marks may be elicited.

2. Rapid cremation or burial of bodies.—The bodies of Hindus on death are cremated and those of Mohammedans are buried on the day of death, usually a few hours after apparent death. European residents also are almost invariably buried on the day they die. Besides these legitimate methods of disposal, very poor people often throw the bodies into rivers and lakes. Unusual facilities thus exist for destroying traces of murder by concealing the dead bodies in rivers, wells, ponds, swamps, dry watercourses, thickets of waste land and jungle, rubbish heaps, standing crops, stacks of wheat or straw, or heaps of chaff. Most of these places are infested by carrion feeders (dogs, jackals, vultures, crows, crocodiles, fish, rats, etc.), which soon mangle the corpse beyond recognition or reduce it to a skeleton. The commonest way of disposing of the body of a murdered person in the plains is to throw it into a river, or into a disused well—for this purpose it may be trussed up and carried many miles from the scene of murder, or tied to a pole and dragged along if the murderer be single-handed. The next most common way is probably to hide it in the jungle. Occasionally such bodies are hurried under the mud floors of houses, and usually in the house of an innocent party. Certain Hindus who murdered a fellow-Hindu and his mistress plotted to bury the woman's body in a Mohammedan grave, which no one would think of opening, and to leave the man's body in the house to make it appear that he had been murdered by his mistress, who had absconded. A case came under my² notice where the body of the murdered man was buried in the bed of a hill stream, which for this purpose had been diverted from its channel and then turned on again.

3. Insufficient particulars in the police-report which accompanies the body.—In India the medical officer rarely

¹ *Nix. Ad. Rept.*, N.-W. P., 1854, 201; *id.*, 1852, p. 1121

² L. A. Waddell. It occurred in the Ranchi District of Chota Nagpur in 1886, while I was acting there as civil surgeon.

sees the dead body when and where it is found, and has to depend for such important information on the meagre and vague reports of untrained persons. Such statements as "believed to be beaten," etc., are often contradictory, and give little useful or trustworthy clues. Although it is a principle in England that the medical officer should be furnished with as full particulars as possible to assist him in finding out the true cause of death, this principle has been objected to by an Indian judge.¹ If, however, the medical officer, who holds the position of a police-surgeon, be purposely kept in the dark as to the facts and ascertained circumstances attending a death on which he has to report, with only the decomposed body available for examination, there must necessarily be a great likelihood of justice miscarrying.

4. Falseness of much of the evidence given by natives of India.

—MANU CODE, 11, 26²

Yet the disgrace of perjury is also insisted upon: "*Naked and shorn, tormented with hunger and thirst and deprived of sight, shall the man who gives false evidence go with a potsherd to beg food at the door of his enemy.*"—MANU, 9, 235, 319, 325.³

The untrustworthiness of native evidence in India is notorious. In nearly every case in law, more or less false evidence is given, whether it be from fear, stupidity, apathy,

malice, or innate deceit. It is referred to by the Privy Council as¹ "the lamentable disregard of truth prevailing amongst the natives of India." As regards Bengal, the Inspector-General of Police² states that this "is a country where perjury is the rule and not the exception, where no man will tell the whole truth or the simple truth . . . where false witnesses can be bought for a few annas." The constant difficulty, therefore, is to sift the truth from the falsehood. Such false charges are generally supported by marvellously minute direct and circumstantial details. The "too perfect" character, indeed, of such evidence at times leads to it being suspected and its falsity exposed.

A very common form of conspiracy is to cause a person to disappear, and then to charge with murder some person against whom a spite is cherished. A plausible explanation is given of the disappearance of the body of the alleged murdered person, or a putrid corpse is obtained from the adjoining river and, gashing it in several places, it is brought forward as the remains of the missing individual. In such conspiracies circumstantial details are not infrequently sworn to by several persons, testifying as eye-witnesses to alleged facts of the murder, to the burial of the corpse, etc., so that conviction for the murder may be duly passed, and the falsity of the whole proceedings not be discovered until the reappearance alive of the alleged murdered person.

in a subterranean chamber of a tomb. It then turned out that the whole affair was a *maḥājān's* next heir *jan's* servants, first his wife. Her loud abductee the wife and handed her over to the *faḥīrs*, in whose custody

belce was still alive was a subordinate in the affair, who was dissatisfied with the remuneration given him for his services.—Chevers, *Man.*, p. 54.

(b) Regarding another case, the sessions judge wrote—"It would be impossible to imagine a case more completely satisfactory as regards at least the guilt of Abdool Kurem [the falsely accused] than this,

¹ Cowell, quoted by Chevers, *ML*, p. 85.

² *Rept. Beng. Police for 1866*, pp. 10, 53.

because when the [police] darogah's report was completed, and as in fact it remained until the appearance of Pertab Narain [the alleged

and no contradictions in the evidence, which from first to last gave the hearers the impression that a heinous crime had indeed at last been brought to light, in spite of a powerful combination to conceal it."—*Niz. Ad. Rept.*, 1853, I. 259. Other cases of this kind.—*Niz. Ad. Rept.*, N.W.P., 1854, 381; *Police Rept.*, L. P. 1844, p. 37.

False confessions of fictitious murder.—The falsely accused persons, even when not the subject of delusional insanity, may confess to have done the alleged murder and yet the alleged murdered person appears alive in court:—

missing widow appeared, she had heard by chance that her brothers were charged with killing her, and came forward to clear them. The brothers said they had confessed to the murder because they thought it was hopeless to plead innocence.—*Chevers, Med. Jur.*, p. 69.

False evidence fabricated by police.—The native police, whose duty it is to make the preliminary report on criminal cases, are drawn from the ranks of the masses, and many are still credited with suppressing incriminating evidence for a monetary consideration, as well as with extorting false confessions by torture or threats through mistaken zeal or other motive, all tending to obscure the truth. Thus a head constable at Rangpur in Bengal induced a woman to say that a certain corpse found floating on a river was that of her adopted father. He further instigated her to charge five men with the murder. At this juncture a sub-inspector took up the case, and the five men were arrested and kept for the night in the custody of these constables, who maltreated their prisoners and thereby induced them to confess that they had committed the murder. When the trial was going on the missing man came into court.¹ Again a sessions judge records:—"I do not credit the evidence of the eye-witnesses as to the place where and the mode in which the wound was inflicted . . . the eye-testimony of the knife and the blow on the road was an after-thought of the police to make the case more complete according to their infamous custom in these

¹ *I.G. Bengal Police Rept.*, 1866, p. 47.

parts"¹ So much suspicion clings to the evidence offered by the police that it is specially enacted that² "no statement made by any person to a police officer in the course of an investigation under this chapter shall, if taken down in writing, be signed by the person making it, nor shall such writing be used as evidence."

The Indian Criminal.

Indian experience generally supports the modern school of criminal anthropologists in regarding the criminal as a degenerate. Lombroso's hypothesis, which originally was that a criminal type exists exhibiting a physical neurosis, or degeneration of the brain that enables us to recognize a malefactor from birth, has now undergone a good deal of change. So far, no physical signs which point to absolute criminality have been discovered, any more than it has been possible to discover the external marks of invincible honesty. Yet, although the great malefactor is not usually a madman, but exhibits a marked degree of self-control, lower down in the scale of criminality, it is often very difficult to decide how far the creature in the dock is truly responsible. Certainly, prisons all the world over contain a considerable proportion of persons under punishment who are little better than half-witted. The population of almost any of the large prisons exhausts the scale of unfitness, and from it is recruited a good deal of the population of the lunatic asylum.

The classification of criminals by Lombroso still holds generally good, namely (1) the *political criminal*, who may be, as the Italian sociologist calls him, "the true precursor of the progressive movement of humanity," and may be the hero, martyr, or even saint of another land or age; (2) the "*criminal by passion*," usually distinguished by a previous honest life and genuine remorse; he never becomes a recidivist, his crime is usually a solitary event in his life, and careful examination as a rule fails to show any striking evidence of abnormality, degeneration, or hereditary taint in the political criminal or the criminal by passion; (3) the *occasional criminal*, who has an element of innate criminality which leads him to commit crime when an opportunity offers, and bad heredity is common in this class; (4) the *habitual, or professional criminal*, who deliberately adopts a career of crime, and commits it either helplessly, the degenerate class, or with great intelligence, the aristocracy of criminality; (5) instinctive or congenital criminals

¹ *Niz. Ad. Repts.*, V., Part 2, 1855, p. 812.

² *C. P. C.*, s. 162.

(*criminel-né* of the French, *delinquente nato* of the Italian). Lombroso identifies the instinctive criminal with the moral insane. Criminals of this class form only a small percentage of the prison population, but they are the most serious proportion. They frequently present well-marked physical and psychical signs of abnormality, degeneration, or disease. They reveal criminality in its most pronounced shape, and they are related on one side to the occasional criminal, and, on the other, pass gradually into (6) the *insane criminal*, without any clear line of demarcation between them.

That the criminal is "an epileptic more or less in disguise" is no longer held, as it is not supported by fact; but that the criminal type is often a "*professional*" type has a good deal in its favour, though the rapid extinction of vicious families who choose such a career is not favourable to the hereditary transmission of such aptitudes.

As an outcome of this conception of the criminal as a degenerate and a more or less half-witted person, there has been put forward the ethical and eugenistic plea for the reclamation and education of the criminal, less rigorous punishment, and the total abolition of the death penalty, for no doubt crime springs from conditions which punishment cannot touch. But these questions are outside the scope of this book.

The Indian criminals are perhaps, broadly speaking, of a somewhat milder and less vicious type than the average criminal in Europe. There are relatively fewer of that gross, anti-social type of moral monster who infest society under the stress of the higher civilization. The great majority of violent criminals and murderers in India are "*criminals by passion*," fairly well-meaning and generally law-abiding men, who, stung into sudden madness by some insult or wrong, real or fancied, to themselves or families, take justice or retaliation into their own hands, and so find themselves in the clutches of the Law. A large number are criminal through natural stupidity and want of self-control, rather than inherent wickedness.

Moral Insensibility, a truly criminal trait, is, however, often seen in atrociously unnatural motives for crime in India. It appears also to enter into the well-known apathy, usually considered fatalistic, amongst natives of India, towards saving life in accidents. People will look on calmly at the struggles of a drowning man without attempting to render him assistance, and often do not attempt to save the victims of attempted murder. Thus, a young woman was seen by a man at noon to throw a boy of ten down a dry well twenty feet deep. The man never attempted either to catch the murderess or to

help the child in the well. He excused himself by saying that he had a boil on his foot and a load on his back. Without throwing down his load he went on to his village, and informed the child's father. The latter, again, made no attempt to recover the body until the evening.

Inhuman *callousness* is sometimes displayed: thus, a woman murdered a child for its ornaments, which were worth less than six rupees (about eight shillings), and was found burning the child's body at her own fireplace (*Beng. Pol. Rept.*, 1866, 172).

Murder of own family to fasten a charge on an enemy.—The victim is usually an old infirm person or a child. Numerous such cases occur every year. A woman in Patna district poisoned her own little daughter, and concealing the body on the premises of a neighbour with whom she was at enmity, accused him of having murdered her.¹ "A man in Jhansi (1885) killed his daughter because his neighbour had slandered her in order that the girl's blood might be upon the neighbour's head. A master murdered his servant (1881) and threw the body before the door of his enemy solely in order to bring a false charge against the latter. A similar case occurred in Azamgarh five years later; a boy was murdered by his grandfather and uncle, they threw the body into a sugar-cane field, and then charged the owner with the crime. A still stranger story comes from the Mathura district. Randhir, a Jat, who had once been a thriving man in Randhirpur, fell into the hands of the money-lenders, lost his property and his house, and became for some crooked reason embittered against his old fellow-villagers. He made up his mind to bring them into trouble. Taking his chopper with him, he met a little *chamār* girl, whom he took into a temple in Bahadurpur. There he cut her throat and slightly wounded himself, and then brought a charge of dacoity and murder against the people of his old village."² A man sentenced at Cawnpore as accessory to the murder of his own sister confessed that the deceased's own son and another relative had beaten her to death and had absconded with her property, and that he afterwards witnessed the partial burial of her body in one of the apartments of the house in which they all resided as a joint-family. He had deceived the neighbours as to the cause of the unpleasant effluvia which proceeded from his house, by attributing it to the death of a snake in one of the drains. The body was found several days

¹ *Bengal Police Rept.*, 1863, p. 139.

² *Kitt's Serious Crime in an Indian Province*, 1889, pp. 14, 15.

after the murder in a locked room, the key of which was in the prisoner's possession.¹

Case.—(a) Murder of father by son amid crowd of witnesses in broad day to lay false charge at another man's door. In 1903, a dhobi of the village of Kalanjari, thana Jani, in the district of Meerut, found that

a chaukidar to fetch the three suspected Dhanuks. In answer to the summons, about a dozen Dhanuks turned up with their women-folk, making a great noise as they approached Jhunku's house. They were armed with *lathis*, and evidently meant mischief. Niaz Ahmad asked them the reason of this conduct, and one Saria, who seems to have been the ringleader of the party, replied "Jhunku wants to get us all sun- will do it." Jhunku replied, "those who are the thieves will "Don't make a noise, justice ?" replied Saria, "we will get

was standing beside him, a push, with the result that the old man fell,

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on his chest. The police and zemindars appear to have made some ineffectual attempt at rescue. The Dhanuk tumbled the old fellow on to a charpoy and marched away in the direction of Meerut. There are two witnesses who state that they encountered the party on its way to Meerut, and that the Dhanuks told them that Chumman had been assaulted by Jhunku, and that they were taking him to the police-station. Chumman, however, feebly protested from the charpoy, saying that he had been assaulted by the Dhanuks themselves, and that they wanted him to bring a false case against Jhunku. By the time they reached Meerut old Chumman was dead, and the Dhanuks charged Jhunku and several others with the murder, saying that the reason for the crime was that Jhunku and the police had demanded money from them in connection

revolting, and the judge agreed with him. He sentenced Saria to be hanged, three others to be transported for life for the murder, besides finding them guilty of fabricating evidence against Jhunku, with the

¹ *Niz. Ad. Repts.*, N-W P, 1883, p 765.

murder. He found six more
 and sentenced them to
 High Court, JJ. Knox and
 Blair, 1902

Case—(b) Murdering adult brother—On the morning of the 17th December 1901 the decapitated body of one Tahal Singh was found in

police report, "that on the 16th December the murdered man and his brother Mahal Singh were drinking at a liquor shop in Nowshera, and

him and his murdered brother (Tahal Singh), and Pertap Singh's son had a similar charge pending against the lumbadar. They arranged that Tahal Singh should be murdered, his body put in Pertap Singh's field, and a charge of murder sent to be killed for this; the party proceeded after lumbadar carrying a *gand* threw Tahal Singh down, flung clothes to accused N murdered man by the hair, while he himself and Bela Singh, accused No. 4, each seized a leg. Budha Singh, accused No. 1, decapitated the deceased with the *gandasa*. All then went to Kotla, where they washed their hands and feet at a well and burned some of the murdered man's clothes in the lumbadar's courtyard. The *gandasa* belonged to accused No. 1 and was found in his house by the police."—*C.M.G.*, 11th Feby., 1902.

Case—(c) Butcher murders his child to please paramour.—In June, 1901, before the Allahabad High Court, Mula, a butcher of the sweeper caste, resident of mohalla Naumandi, Relahganj, Agra, was convicted for the murder of his daughter, a child of four years of age. According to the evidence and the confession of the accused, Mula had had an intimacy with Musamat Koka, a sweeper, and used to live at her house. Shortly before the murder took place Koka left Mula and went back to live with her own husband. This seems to have put Mula into a state of fury, and

took his daughter to the slaughter-house, where he was employed as a

butcher, and cut the child's throat in the manner animals are slaughtered. The man then took the body of the little girl to the house of Koka and entered the room in which she and her husband were sleeping. Before awaking Musamat Koka he laid the body of the girl on a bed on which Koka's husband and Koka's son were sleeping. He then roused the

Self-murder in revenge.—Cases are sometimes met with in which an individual who has been injured by another kills himself under the idea that he thereby throws the responsibility for his death on the person who has injured him. Instances quoted by Chevers show that, under the name of '*chandi*' this form of suicide was a well-known custom among the ancient Rajputs. A variety of this description of suicide is the practice known as sitting '*dharna*' or starving himself at the door of an enemy or debtor. Again, Chevers mentions a case of a man at Singapur who cut his throat at the door of his neighbour in order to try to get the latter hanged.

Parents sometimes conceal the murder of their son or daughter, and report the death as being due to attack by wild beasts or suicide.¹ So common is this moral insensibility to natural ties that the High Court refers to it as "instances of persons consenting to forego the prosecution of those who have committed the most serious injuries to their persons or properties are within the common experience of every magistrate in this country."²

Some Special Causes of Crime in India.

A good deal of the crime against the person in India is the result of the primitive social state of the mass of the people and the observance of semi-barbarous cults and traditions handed down from the past, and often based upon primitive tribal instincts of self-preservation, but which now under British rule are illegal and criminal.

Traditional Customs.—Many such practices which nowadays under British rule are crimes were not deemed to be such under Hindu and Mohammedan rule. Instances of these are the burning of widows alive on the funeral pyre; female infanticide; burial of lepers alive, '*justifiable suicide*', condonable murder or manslaughter (see below), and avenging certain wrongs,

¹ *Beng Police Rept*, 1849, p. 8

² *Nuz. Ad. Repts.*, Vol. VI (1856), p. 501.

e.g. adultery, by taking the law into one's own hands. In ancient India the avenging of all criminal justice remained in the hands of those who were wronged, and still to the present day it is not fully recognized that the enactments under British rule have diminished the sphere of private revenge. *Mutilation* of nearly every part of the body was authorized as a punishment in Hindu law. Thus, the hand or foot, both hands, one hand and one foot, both hands and both feet, buttock, lip, penis, testicles, pudenda, rectum, ears, nose, breaking the teeth, finger or fingers, piercing or gouging out the eyes, etc., were specified punishments. *Burial alive* was a recognized Mohammedan torture, and Hindu sacrifice is still sometimes practised even nowadays. *Torture* is still believed to be often resorted to clandestinely by the police to exact evidence, and trial by ordeal is still not infrequent.

In the Vedas the crime of manslaughter (*Vaira-hatya*) was condoned on payment of the price or blood-money termed *Vaira*, payable to the relatives of the man killed. The scale of payment prescribed was 1000 cows for a person of the Ksatriya caste, 100 for Vaisya, and 10 for a Sudra, and over and above this was in each case a bull which it is supposed was the perquisite of the king for his judicial intervention. The crime of slaying a Brahmin was too heinous for a fine. It was a sin which could only be expiated by the performance of a horse-sacrifice (*Aśvamedha*), the *ne plus ultra* of generosity to Brahmins. In this sacrifice the human victims seem to have included not only the plaintiff and defendant but also the arbitrator.—*Vedic Index*, Macdonell and Keith, 1912, I, 331, 391, 393.

himself from an eminence, or by ascending to paradise by a respectful pilgrimage to the Himalaya Mountains. Whoever relinquishes life under these circumstances, by precipitating himself from the sacred vista tree at Prayāga, or, his time being come, destroys himself, that high-minded person shall receive a great reward in a future state, and shall not be

Nis. Ad., I. pp. 220-1.

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woman to another village where the husband was sent for, and his wife made over to him, and a cart and bullocks lent him to take her to his

grave, with the leg of a woman clearly visible. They then heard the buried woman say, "I am not dead," and she then told the *Kotwar* that her husband had buried her. The woman's brother-in-law and daughter were sent for, and they lifted the buried woman out of the rough grave and gave her food. She was sent to the Badnur hospital and lived on for some twelve days longer. The extraordinary part of the story, apart from the callousness and superstition of the husband, is the fact that the poor woman must have lain in the shallow grave, covered with leaves and branches, for six or seven days without food or water. The accused was sentenced to transportation for life.—*King Emperor v. Dama Gaiht*, 302 P. C., 1907

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were extracted.—*Mad. C.E. Rept*, 1900, p. 8.

In Burma, a short spell of organized robbery with assault ('dacoity') and even murder is still fashionable amongst the youth of that country to prove their daring and manhood to their sweethearts, and is thus from its audacious motive to be distinguished from ordinary crime, though it might be classed with professional crime.

Intoxicants.—The relatively milder type of the average criminal is perhaps in some measure due to the relative infrequency of alcoholic drunkenness amongst Indians, as alcoholism is found to contribute so largely to hereditary crime in Europe. Amongst the Burmese, where spirits are more freely indulged in, murderous assaults even on near relatives are not uncommon under the influence of alcohol, in Rangoon alone over 300 sword-cuts of the head occur annually, many of them fatal. But the intoxicant mostly indulged in by criminal Indians is *Indian Hemp*, which accounts for some of the most violent tragedies, such as 'running amok,' and other maniacal crimes.

Race and Environments.—In so large a continent as India, comprising so many diverse physical features, climates, and races with different social and religious customs, it is to be expected that some of the crimes against the person, and the mode of committing them, should differ somewhat in character in different parts of the country, and be determined to some extent by the different environments of the people.

The softer and less virile people of the enervating plains wreak their spite or vengeance less by personal assaults than by false charges and subtle poison, or, afraid of bodily risk themselves, they hire ruffians to beat or murder their enemy, and scheme deeply to hide their crime; whilst the hardier up-country people and hillmen, taking the law into their own hands, attack openly and slay with their own hands, regardless of personal risk or blame, and are less cunning in concealing their crime. The wilder tribesman lies in wait for the person he believes to have wronged or bewitched him, and on killing his victim, he makes little attempt to hide the body, and usually admits his guilt at once. Certain crimes are confined to certain tribes or castes, such as the poisoning of cattle, especially by *abrus*-seed needles ('*sui*'), which is done by the *chamār* or leather-worker caste with the object of getting cheap hides for their stock-in-trade.

Religion is responsible for several kinds of crime in India. Those '*sati*' murders perpetrated in the name of religion, in which Hindu widows are induced to immolate themselves on the funeral pyre or grave of their husbands, still occasionally occur nearly every year. In 1901 and 1905 cases occurred at Gaya, although it is over eighty years since *sati* was declared illegal by the British Government.¹ Special police precautions have yet to be taken every year to prevent Hindus committing suicide by throwing themselves under the wheels of the idol-car of the god Jagarnath. Female infanticide on account of the religious and social difficulties of marrying daughters still occurs to some extent, especially in Upper India. Abortion and child-murder are most common amongst the unfortunate class of young Hindu widows, for whom re-marriage and social rights are denied by their religion. Amongst Mohammedans sexual crimes are much more frequent than amongst Hindus. Prostitution is much more extensively practised in the muharram months.

Bengal, for example, the greatest number of rape cases are reported from the Mohammedan districts of Mymensingh and Dacca. That fanatical form of homicidal insanity '*running amok*' is more common amongst Mohammedan fanatics than Hindus.

Domestic characteristics are that women, perhaps more so than in Europe, employ poison rather than bodily violence, and

¹ The law against the self immolation of widows was passed by Lord William Bentinck in 1829

their crime is directed for the most part against their husband, or some rival in his affections; also that domestic quarrels over trifling matters are a frequent cause of suicide in India.

Famine.—Under the stress of hunger in years of famine and scarcity there is a marked increase in such crimes as robbery by violence, and poisoning, homicidal and suicidal.

The foregoing account of the special features of Indian crime, it is hoped, may facilitate our study of Indian Medical Jurisprudence, the wide field of which can be conveniently viewed under the following divisions —

	CHAP.
I.—FORENSIC MEDICINE.	
<i>Identification of Persons, Living and Dead</i>	I.
<i>General Examination of the Living in Criminal Cases</i> . .	II.
" " Dead "	III.
<i>Assaults, Wounds, Injuries and Deaths by Violence</i>	
<i>Non-sexual General and Special Wounds and Injuries</i>	IV.
<i>Homicidal v. Suicidal and Self-inflicted Wounds</i> . .	V.
<i>Blood Stains, etc.</i>	VI.
<i>Asphyxial Deaths. Suffocation, } Hanging, Strangling, Drowning }</i>	VII.
<i>Burns, Scalds, Lightning Stroke, etc.</i>	VIII.
<i>Starvation.</i>	IX.
<i>Injuries and Assaults Sexual Crimes and Offences:</i>	
<i>Impotence and Sterility</i>	X.
<i>Virginity and Deforation</i>	XI.
<i>Pregnancy and Legitimacy</i>	XII.
<i>Birth and Delivery, re Inheritance</i>	XIII.
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<i>Abortion, or Fœticide</i>	XV.
<i>Criminal Infanticide</i>	XVI.
<i>Unnatural Sexual Crimes</i>	XVII.
<i>Insanity, in relation to the State</i>	XVIII.
<i>Leprosy, in relation to the Law</i>	XIX.
<i>Life and Accident Assurance</i>	XX.
<i>Medical Obligations and Malpraxis</i>	XXI.
II.—TOXICOLOGY, or POISONING.	
<i>General Characters of Poisons</i>	XXII.
<i>Corrosive and Irritant Mineral Poisons</i>	XXIII.
<i>Irritant Non-Metallic Poisons</i>	XXIV.
" <i>Metallic</i>	XXV.
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" <i>Animal</i>	XXVII.
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" " <i>Spinal</i>	XXIX.
" " <i>Cerebro-Spinal and Cardiac Poisons</i>	XXX.

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PART I.

GENERAL EXAMINATIONS.

CHAPTER I.

IDENTIFICATION OF PERSONS, LIVING AND DEAD.

THE personal identity of the individual in question must be ascertained in all cases which are reported on medico-legally. The medical jurist may also be called upon to establish the identity of a person in cases of suspected foul play resulting in death, and in a great variety of cases, such as alleged assault, rape, disputed sex, fraudulent personation for the purpose of securing property or the prolongation of a lapsed pension, a fraud which is facilitated in this country by the exclusive rights of *pandah nashin* claimed by married women.

Of dead bodies in India it is especially difficult at times to determine the identity, owing to their rapid decomposition by the heat, and their liability to defacement when exposed to the ravages of beasts and birds of prey. On the other hand, the necessity for thorough identification is here all the greater, owing to the custom of rapid burial and cremation, and the

In the **routine examination of ordinary** medico-legal cases, it is always well to get the identity of the person or body in question attested by at least two acquaintances, whose name or names should be noted by you in your record, as the personal identity of the individual examined is of such legal importance.

Identification may thus be required of (a) a living person, (b) a dead body, (c) fragmentary human remains, or (d) bones only. For this purpose you consider (1) the **sex**, (2)

age (p. 41), (3) race and caste (p. 48), and (4) any characteristic personal marks or peculiarities (p. 53).

Sex.

The determination of sex is not usually difficult, as mere inspection of the external genital organs is sufficient to settle most cases otherwise doubtful, without resorting to medical evidence. In cases, however, of suspected murder, where the body is mutilated or only part of it or of the skeleton is available for examination, and in the rare instances of doubtful sex due to malformation where succession to property is concerned, it becomes a much more difficult question, requiring expert evidence, as in under-noted cases. The question of sexual capacity and development also arises sometimes in alleged rape, impotence, etc.

Cases.—(a) Pseudo-hermaphrodite.—Levi Suydam. Suydam presented himself as a freeman, and thus entitled to vote in a contested election. Dr. Barry having found an imperforate penis with a depression in the site of the male meatus, a short urethra opening underneath the penis . . . testis in its . . . to vote. Dr.

regularly menstruated, and had done so for years. His figure was feminine, the breasts were well developed, and on passing a sound into the urethra, instead of reaching the bladder it passed into a cavity like the vagina, three or four inches deep.—*Amer. Med. Jour. Sc.*, July, 1847.

(b) *Æt.* fifty-five at death. General configuration that of a woman (during life celebrated anatomists had formed different opinions as to the sex). At the post mortem there were found, on the right side, a withered testicle, a penis, and a prostate gland, and on the left an ovary, uterus, vagina, and fallopian tube.—*Tidy's Leg. Med.*, i. 353, case 128.

(c) **Female as male.**—Professor A. Powell (Bombay) reports that while he was Resident in Royal Hospital, Belfast, a coal porter, named John Walker, was admitted for a scalp wound infected with erysipelas. "He" had always worked as a porter or dock labourer, and had been married for two years. "He" was found to be a woman with normal vagina and ovaries, but a very large clitoris. At the inquest after "his" death, his "wife" deposed that she had no suspicion "he" was a woman.

(d) "A person affected with hypospadias was married for twenty years, and during all that time was treated as a female. Sexual intercourse was regularly effected by the canal of the urethra, nor was it until the period just mentioned had elapsed, that it was discovered that the individual was a man."—*Orston, Med Jur. Lect.*, p. 52.

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age (p. 41), (3) race and caste (p. 48), and (4) any characteristic personal marks or peculiarities (p. 53).

Sex.

The determination of sex is not usually difficult, as mere inspection of the external genital organs is sufficient to settle most cases otherwise doubtful, without resorting to medical evidence. In cases, however, of suspected murder, where the body is mutilated or only part of it or of the skeleton is available for examination, and in the rare instances of doubtful sex due to malformation where succession to property is concerned, it becomes a much more difficult question, requiring expert evidence, as in under-noted cases. The question of sexual capacity and development also arises sometimes in alleged rape, impotence, etc.

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s in its
right half, pronounced him to be a male and entitled to vote. Dr. Ticknor, who objected at first, came to the same conclusion. A few days after it was discovered, by his sister's and his own confession, that Suydam regularly menstruated, and had done so for years. His figure was feminine, the breasts were well developed; and on passing a sound into the urethra, instead of reaching the bladder it passed into a cavity like the vagina, three or four inches deep.—*Amer. Med. Jour. Sc.*, July, 1847.

(b) *Æt.* fifty-five at death. General configuration that of a woman (during life celebrated anatomists had formed different opinions as to the sex). At the post mortem there were found, on the right side, a withered testicle, a penis, and a prostate gland, and on the left an ovary, uterus, vagina, and fallopian tube—*Tidy's Leg. Med.*, I. 353, case 128.

(c) *Female as male*.—Professor A. Powell (Bombay) reports that while he was Resident in Royal Hospital, Belfast, a coal porter, named John Walker, was admitted for a scalp wound infected with erysipelas. "He" had always worked as a porter or dock labourer, and had been married for two years. "He" was found to be a woman with normal vagina and ovaries, but a very large clitoris. At the inquest after "his" death, his "wife" deposed that she had no suspicion "he" was a woman.

(d) "A person affected with hypospadias was married for twenty years, and during all that time was treated as a female. Sexual intercourse was regularly effected by the canal of the urethra, nor was it until the period just mentioned had elapsed, that it was discovered that the individual was a man."—*Ogston, Med. Jur. Lect.*, p. 52.

(c) Male as female.—In 1905, Dr W. Hind reported case of "Miss X,"

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A remarkable instance of concealed sex was the case of Dr. James Barry, an army surgeon, who rose to the rank of Inspector-General of Hospitals, and after death was discovered to be a female.

Sex of the Living.—This question may arise in connection with malformed infants where property is left to an heir of a specified sex, though what is the characteristic in law of a male is open to discussion

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At a later age this question may occur with reference to malformed individuals as to their (1) education whether as a boy or girl, (2) marriage as a man or woman, or (3) right to vote as a man.

In such cases the sex may be very difficult to determine. No definite rules can be laid down; each case must be decided on its own merits, following the legal rule that the individual is to be of that sex which most predominates.

Essential tests of sex in adults—These are—

1. Possession of a *testicle* accompanied by emissions of fluid containing spermatozoa—that is the strongest possible evidence of a male (but see case of Catherine Hohmann, p. 38).
2. Possession of an *ovary* accompanied by periodic
the *genitals*
The uterus,
appendages.
3. In the absence of the above two characters, the presence of a *uterus* or a second opening behind that leading into the bladder indicates a female.

4. The general configuration of the body when it agrees with these local indications may be considered confirmatory evidence, but if it disagrees it should be disregarded.

Local examination should include, as far as possible, the internal genitals by bimanual and rectal palpation if necessary.

In infants a consideration of the morphology and development of the sexual organs is of assistance, as these abnormalities are due to faulty development in the foetal stage during the differentiation of the sexes.

... if the genital opening is small, and situated in the male ... open, constituting *hypospadias*, which simulates to some extent the female organs, especially if the testicles have not descended. If in the female there be excessive lateral union and growth of the clitoris the condition may stimulate the male.

The chief homologous parts in the male and female are —

Male.	Female.
Glans penis	Clitoris
Prepuce	Nymphæ.
Scrotum	Labia majora
Sinus pocularis	Uterus.
Vas deferens	Ducts of Gaertner
Gubernaculum testis	Round ligament.
Testicle	Ovary.

The abnormal variations arising from faulty development in these organs which may mask the sex are divisible into :—

True Hermaphrodites	{ Where the internal sexual organs of both sexes are present
False Hermaphrodites or Pseudo-Hermaphrodites	{ Where the abnormalities are confined to the external organs.— Androgynæ, or womanly men, whose male organs resemble those of the female. Androgynæ, or manly women, whose female organs resemble the male.

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... and ... may exist as a tumour in the groin (*cryptorchid*). In *Androgynæ* it is usually a case of enlarged clitoris with a prolapsed uterus, the fissure of which is transverse, whilst that of the penis is vertical. In such cases, if

menstruation is found, it is a female; if a testicle or seminal emissions, it is a male.

'True' Hermaphrodites.—The old myth attributed to these beings the possession of organs of both sexes with the power of self-reproduction.

This so-called 'true' hermaphroditism has been divided by Sir W. Simpson¹ into. Lateral.—Testicle on one side and ovary on the other. Transverse.—External organs male and internal female or the reversal. Vertical or double, of three varieties—(a) Ovaries with combined male and female passages, (b) Testicles with combined male and female passages; (c) Ovaries and testicles co-existing on one or both sides. The 'lateral' is considered by Watson to be the only true kind of hermaphroditism, while (c) ought probably to be classed amongst double monsters.

In addition to the local examination the following general characteristics should be considered:—

General sexual characters in adult —

1. General configuration of the body. The shoulders are generally less wide than the hips in females, the reverse in males. The breasts much more developed in females.
2. Hairiness of face and pubes after puberty is greatest in males.
3. Voice is deeper in tone in male, and the *pomum Adami* more prominent.
4. Sexual instinct is assumed to be towards the opposite sex, although there are recorded instances of sexual indulgence of an inverted character (see 'Sodomy,' Chap. XVII, Unnatural Crimes).

Sex of the Dead.—When the entire body is available for examination there will be no difficulty in the great majority of cases in determining the sex, and in doubtful cases of malformed organs dissection will at once reveal the true sex. Any question with regard to the sex of a dead body usually arises when only mutilated fragments of a body or only bones are available for examination. For the identification of such bones the text-books on general anatomy should be consulted.

Sexual characteristics of the skeleton in the female:—

1. The bones are smaller, thinner, and lighter, and muscular attachments less prominent than in the male.
2. The *pelvis* is shallower and wider than in the male, which is deeper and narrower. The ilium is more expanded, sacrum more concave than the male (where it is straighter), the symphysis shorter, pubic arch wider, with edges more diverged, foramina more triangular and outlets larger than in the male.
3. The ribs have a greater curvature than in the male.

¹ *Med. Times and Gaz.*, June 23, 1873, and *Am. Journ. Obstetrics*, 1876, p. 615.

² *Todd's Cyclop. of Anatomy*.

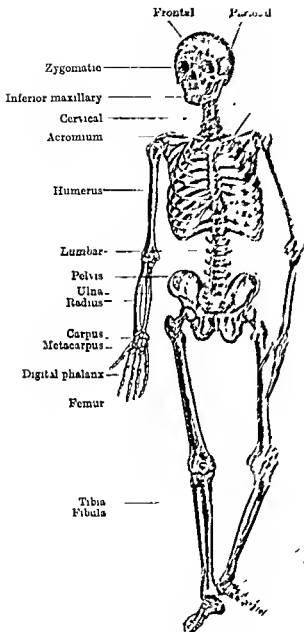


FIG 1—Human Male

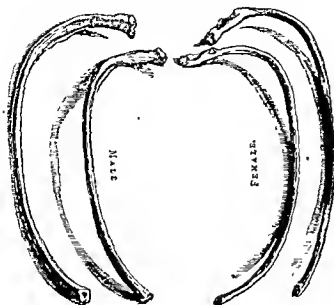


FIG 2.—Curvature of Female Rib & Male

The average measurement of the bones (see Fig. 1) in each sex, for Europeans, are here detailed:—

MEASUREMENTS OF BONES AT DIFFERENT AGES (IN INCHES) ¹

Age	Height.	Cephe	Circumference of skull	Humerus	Radius	Ulna	Femur	Tibia	Foot	Pelvis	
										Transverse diameter of	Antero-posterior
								35	35	13	13
								51	51	22	22
								71	71	25	25
								94	94	31	31
								110	110	40	40
								115	115	—	—
								116	80	38	36
								128	80	50	48
								130	80	59	58
								133	83	47	45
age)	65	22 2	20 5	12 7	9 2	7 3	17 68	14 4	10 6	5 2	4 3

¹ From Dr. Humphrey, *The Human Skeleton*.

Age.

The determination of age may be required for the identification of an individual, living or dead, as well as for the question of criminal or civil responsibility in regard to marriage, fecundity, rape, viability in relation to infanticide, making wills, capability as a witness, employment under the Indian Factory Act, etc.

Age in criminal responsibility.—Children under the age of seven are deemed incapable of committing an offence. Children between the ages of seven and twelve in India (seven and fourteen in England) are only deemed capable of committing offences if they have attained a certain degree of maturity of understanding (*I. P. Code*, ss. 82, 83). Sexual intercourse with a girl under the age of twelve in India is 'rape,' even if the girl consents or is the individual's own wife (*I. P. Code*, s. 377, see also 'Rapo'). In England sexual intercourse with consent is a felony up to the age of thirteen, and between the ages of thirteen and sixteen, is a misdemeanour and punishable as such.¹ In India, however, the law is in practice assimilated to that of England, by the prosecution, when failing to prove a child to be under 12, often indicting the accused under s. 361, *I. P. C.*, for 'enticing' or 'kidnapping,' or under s. 373 for "buying, hiring or otherwise obtaining for prostitution or any unlawful or immoral purpose," or under s. 373 for "selling, letting to hire or otherwise disposing of any minor under sixteen," which make connection with a girl under sixteen an "offence", and then the surgeon has to inquire whether the girl be under or over sixteen. Only a person over the age of twelve can give a valid consent to suffer any harm which may result from an act done in good faith, and for the sufferer's benefit (*I. P. C.*, s. 90), and in cases where the act does not come within this description, the consenting individual must be at the age of eighteen or more, for his consent to be valid (*I. P. C.*, s. 87).

Age-capacity to contract marriage.—According to the law of England, females under the age of twelve, and males under the age of fourteen, cannot contract marriage. In India consummation of marriage is illegal under the age of twelve, see above.

Attainment of majority.—In England majority is attained at twenty-one. Persons under this age are minors. A minor cannot make a valid will, cannot alienate his goods by deed, cannot be called upon to serve on a jury, etc. Certain

¹ *Criminal Law Amendment Act*, 1885 (48 & 49 Vict. c. 69). Section 7 of this Act also makes it an offence to abduct an unmarried girl under eighteen with intent that she should be unlawfully and carnally known by any man.

cases excepted, persons domiciled in British India attain majority on completion of their eighteenth year, except when under a guardian appointed by a court or under a Court of Wards, when the individual does not attain majority until completion of twenty-one years of age (Act IX. of 1875, s. 3). Legally an individual attains a given age on the first minute of the day before his birthday, *e.g.* an individual in England who, popularly speaking, will be twenty-one on the 3rd of May, will legally cease to be a minor at the end of the last minute of the 1st of May.

Eligibility for employment under the Indian Factory Act.—In England, in factories children under eight may not be employed, and children between eight and thirteen may only be employed for six and a half hours per day; and only males and females, between thirteen and eighteen, may be employed for sixty hours per week. The Indian Factories Act (XV. of 1881) provides that, in factories coming under its operation, no child under the age of seven shall be employed, and that children between the ages of seven and twelve shall not be employed for more than nine hours per day, and shall have one hour daily for rest, and four holidays per month.

Mode of Estimating Age.

The chief data for estimating the age of an individual are—(1) the teeth, (2) height and weight, (3) hair and breast development, (4) degenerative changes, (5) extent of ossification.

In the Living, age can only be estimated with any degree of certainty in the young. After adult life is reached, the age is only to be guessed at approximately, in the absence of a regular certificate of birth or a horoscope. The points to be noted are:—

(1) **Teeth.**—These yield indications of age up till the thirteenth or fourteenth year, and with the 'wisdom teeth' up to the eighteenth year. The *temporary* or 'milk teeth' usually appear in the following order:—

TEMPORARY OR MILK TEETH ERUPTION.

Eruptive Order.	Name	Age.
1	Lower central incisors	6th to 7th month
2	Upper " "	7th to 8th "
3	Upper lateral " "	7th to 9th "
4	Lower " "	10th to 12th "
5	1st temporary molars	12th to 14th "
6	Cannines	17th to 18th "
7	2nd temporary molars	2nd year (often later)

In certain weakly children, especially those suffering from rickets, the dentition may be delayed, while in syphilis the teeth may be premature, and even present when the child is born.

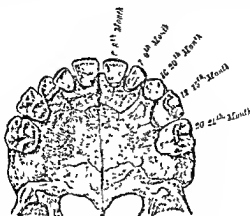


FIG 3.—Temporary Teeth (upper jaw) ¹

The *Permanent Teeth* are thirty-two in number, 16 in each jaw. The following table by Professor A. Powell, while the police-surgeon of Bombay, gives the order of their appearance for India according to a very large series of observations by him.²

	Powell, for natives of India.	Saunders	Bedley	Gray	Mann
	year	year	year	year	year
First molar .	6th to 7th	8th	6th	7th	7th
Central incisor	7th	9th	7th	7th	8th
Lateral .	8th to 9th	10th	8th	8th	9th
Canine ..	10th to 13th	13th	11th to 12th	11th to 12th	11th to 13th
Anterior pre- molars or bicuspid	9th to 10th	11th	9th	9th	10th
Posterior pre- molars	10th to 12th	12th	10th	10th	11th to 15th
Second molar	11th to 12th	13th to 15th	12th	12th to 13th	13th to 16th
"Wisdom"	14th to 27th	18th to 25th	17th to 25th	17th to 21st	18th to 30th

In natives of India a few exceptions may be found to these figures, but these exceptions will be found on the precocious side, rarely at later dates.

Generally, a child of nine should have 12 permanent teeth; at ten or eleven, 24, at thirteen or fourteen he will have 28.

¹ From Macalister's *Human Anatomy*

² I M G 1902, p 220

In a case at Chingleput, Madras,¹ the age was decided wrongly to be between twelve and thirteen because the permanent second molar teeth were ready to come through. In advanced



FIG. 4.—Permanent Teeth *

life the teeth become worn down and discoloured, and more or less are lost.

Dr Powell notes that:—The first molars appear with great regularity in the sixth or seventh year. Of forty-one children, aged seven, all had their first permanent molars. The central incisors appear during the

the ninth or tenth, the posterior from the tenth to the twelfth year. The second molars come with great regularity in the eleventh or twelfth year. They may appear earlier, but *I have never seen a Hindu or Mussulman child of twelve without second molars.* I have seen two Parsis, aged 12½, without permanent second molars. I have seen wisdom teeth in Hindu children aged 13½, 13¼, and 13½. A few extraordinary irregularities may be found, but such freaks do not invalidate the general rules. I have known a European cut a wisdom tooth at thirty-six. Ackery quotes a case of temporary molars retained at 63, and Salter quotes a case of the same teeth being retained at 65.

To distinguish the permanent from the deciduous or temporary teeth is not always easy. Professor Powell gives the following directions:—

Taylor says the milk teeth are smaller than those that replace them. How is the surgeon to compare? This is not true of the deciduous molars. These are usually larger than the bicusps which replace them

* J. Short, *Madras J. Med. Sc.*, 1862, p. 227.

* From Macalister's *Human Anatomy*

The anterior milk teeth are vertical, the permanent are usually inclined somewhat forward. The crowns of the milk teeth are of a white, china-like colour as compared with the ivory white of the permanent. The junction of the crown with the fang of the milk tooth is often marked by a ridge which is not seen in the permanent. 'Mercurial' teeth and Hutchinson's teeth must be of the permanent set.

2. Height and weight.—There are no special Indian observations on the relations of height and weight to age. The following table is based on data in England, where the average height is slightly more than in India.

Males			Females		
Age last birthday	Height ft. in.	Weight st. lb.	Age last birthday	Height ft. in.	Weight st. lb.
1	2 9½	18½	1	2 3½	—
2	2 9½	2 4½	2	2 8½	1 11½
3	3 0½	2 6	3	3 0½	2 3½
4	3 2½	2 9	4	3 2½	2 8
5	3 5	2 12	5	3 4½	2 11
6	3 8	3 2½	6	3 6½	2 18½
7	3 10	3 7½	7	3 8½	3 5½
8	3 11	3 13	8	3 10½	3 10
9	4 1½	4 4½	9	4 0½	3 18½
10	4 3½	4 11½	10	4 3	4 0
11	4 5½	5 2	11	4 5	4 12
12	4 7	5 6½	12	4 7½	5 6½
13	4 9	5 12½	13	4 9½	6 8
14	4 11½	6 8	14	4 11½	6 12½
15	5 2½	7 4½	15	5 1	7 8½
16	5 4½	8 7	16	5 1½	8 1
17	5 6½	9 5	17	5 2½	8 8½
18	5 7	9 11½	18	5 2½	8 9
19	5 7½	9 13½	19	5 2½	8 12
20	5 7½	10 3½	20	5 3	8 11½
21	5 7½	10 5	21	5 3	8 10
22	5 7½	10 7	22	5 2½	8 11½
23	5 7½	10 7½	23	5 3	8 12
24	5 7½	10 8	24	5 2½	8 9
25-30	5 7½	10 12½	25-30	5 2	8 8
30-35	5 8	11 6	30-35	5 1	8 9

The weight slightly diminishes in old age. English children attain half their adult weight at about 12 in case of boys, and under 11 in case of girls, as in this table¹

Age.	Males.		Females	
	Height in inches.	Weight in lbs.	Height in inches.	Weight in lbs.
8 years	46.66	55.03	46.73	52.52
9 "	49.21	60.02	48.63	56.53
10 "	51.00	65.29	50.07	61.19
11 "	52.67	71.01	53.66	66.00
12 "	54.03	75.00	54.41	75.53

¹ Dr. Bridges, *Measure on prison data*, calculated from children in non-factory districts.

The average weight of Indian children at birth has been estimated at $5\frac{1}{2}$ lbs¹; that of English children at birth at $6\frac{1}{2}$ lbs, and during the first year after birth about one pound is gained each month.² Of adults the average height and weight in the majority of Indian races is lower than that of Europeans. Buchanan gives the average weight of a Bengali at 109 lbs. Lewis gives under 110 lbs as the average weight of N.-W. Provinces men. Buchanan's formula for calculating the weight for the height is: Taking 5 feet as equal to 100 lbs., add 3 lbs. in weight for every full inch above that, *e.g.* 5 ft. 6 in. = $100 + 3 \times 6 = 118$ lbs. In men over 5 ft. 8 in. add 4 lbs. for each inch.

For Europeans —Average height, without shoes, and average weight, with clothes of all classes (town and country) of the general population

actually heavier than boys. (4) From 15 to 20, boys begin again to increase more rapidly than girls, and complete their growth at about 23. (5) After 15, girls grow more slowly, and practically reach their full height and weight at 20. During childhood and adolescence increase in weight is more marked in the winter, and increase in height in the summer.

3. Hair on pubes and armpits. This growth begins about ten or eleven years of age, and in boys about fifteen to eighteen is attended by deepening of voice.

4. Breast development. Puberty varies greatly in time. In native girls it begins at twelve to thirteen (see Chap. III). In some women it is not until twenty sometimes have not menstruated; and Dr. Powell cites a case of a child, aged four, who had a discharge of blood from the vagina every six or eight weeks, and the labia were large, and the breasts as large as the halves of a moderate size orange.³ It is accepted as a good defence in England in cases of alleged rape when consent is admitted or proved that the judge or jury is satisfied that the girl looks sixteen, and might have been supposed by the accused to be sixteen years of age, irrespective of her actual age.

4. Degenerative changes.—Wrinkles, grey hair, *arcus senilis*, which is rare before forty, change in angle of the lower jaw. The angle of lower jaw, which is obtuse in infants, becomes

¹ Harvey, *loc. cit.*

² *I. M. G.*, 1902.

³ According to Toddy.

nearly a right angle in young adults, and in advanced old age becomes again obtuse and shallow, through absorption of the alveolar portion.

5. Ossification.—Although this is less easily and certainly observable in the living than in the dead, the *Roentgen rays* enable it to be observed in the former, and it is of especial importance in charges complementary of rape where the surgeon has to inquire whether the girl be under or over sixteen.

For points of Ossification see table. The epiphysis at the knee-joint unites at the sixteenth year and not the seventeenth to the twenty-fourth as stated in the anatomy books.¹ The external condyle of the humerus about 13th or 14th year.² Internal condyle 17th or 18th year;

the X-rays The pisiform bone in children over twelve usually shows ossification. Its absence is strong evidence that the child is under twelve.

Age in the Dead.—Here, in addition to the foregoing points regarding dentition and height-weight, it is possible to make more extensive use of an examination of the bones for that other precise criterion of age—the progress of ossification, as in Ogston's table on next page.

ages (stated in years). At 2½, patella, at 3, cuboid; at 4, trapezoid and second and third tarsal cuneiform, at 5, semilunar and carpal scaphoid, and at 12 in the pisiform bones

(3) Bony union takes place at one year, of the posterior arches with the bodies of the vertebrae, and of the three portions of the temporal bone. At 3 years, of the odontoid process with the axis, at 4 years, of the styloid process with the temporal bone; at 6 years, of the ascending and descending rami of the pubis, at 9 years of the three portions of the os innominatum in the acetabulum, at 15 years, of the last four sacral vertebrae, and of the coracoid with the scapula, at about 25, all the epiphyses have united; and at 25 to 30, the first sacral vertebra unites with the others.

(4) As age advances the rib and laryngeal cartilages become ossified and the skull becomes thinned by absorption of diploe

The above directions apply also to fragmentary portions of

¹ Dr. Carl Beck, *Journ. Amer. Med. Ass.*, 5th January, 1901.

² Quain Dr. A. Powell gives 16th to 17th year

³ Dr. A. Powell, *loc. cit.*

a body or skeleton, in regard to which consult Dr. Humphrey's table on p. 40, from which the age may be approximately estimated from isolated bones.

THE PROCESS OF OSSIFICATION

Age after birth	Points of ossification appear at	Bony union occurs between
4 months	Cornua of hyoid	—
5 "	Cornicula of hyoid	—
6 "	Anterior arch of atlas	Alæ majores and body of sphenoid
1 year	Lower end of humerus, heads of humerus, femur, and tibia, 1st cuneiform bones	Posterior arches and body of vertebrae; portions of the temporal bone, except styloid process.
2 year-	Lower ends of radius, tibia, and fibula, ends of metacarpal and metatarsal bones	—
2½ "	Patella, lesser tuberosity of humerus and four smaller metacarpal bones	—
3 "	Cuboid and large trochanter	Odontoid and axis
4 "	Trapezoid, 2nd and 3rd cuneiform.	Styloid process and temporal bone
5 "	Semilunar, carpal scaphoid, head of fibula, ends of finger bones	Rami and body of vertebrae dentata.
6 "	Proximal epiphyses of four smaller toes	Rami of pubis and ischium
7 "	Trochlea of humerus	—
7 to 9 "	Olecranon and scaphoid	The two bony points at head of humerus
9 "	—	Three portions of os innominatum.
12 "	Pisiform	—
14 "	Neck and lesser trochanter of femur.	—
15 "	Inferior angle of scapula	Last 4 sacral vertebrae; coracoid and body of scapula
15 to 20 "	Sternal end of clavicle, coccyx.	Shaft of femur and its epiphyses, humerus and its epiphyses
18 to 23 "	—	Sphenoid and occipital; tibia and its epiphyses, 1st and middle portions of sternum, epiphyses and body of ribs
25 to 30 "	—	First sacral vertebra and rest of sacrum.

Race and Caste.

It is not often that this requires to be proved, but the question might arise with reference to the dead bodies of unknown persons. Certain external of dress and conventional

markings serve to distinguish Hindus generally from Mohammedans. The chief of these are here tabulated:—

	Mohammedans	Hindus
Males	1. Circumcision marks, over 11 years of age.	1 Not circumcised.
	2. Ears not pierced, or only one	2 Both ear lobes pierced
	3. Crown entirely shaved	3. Hair tuft retained when crown shaved.
	4. Callosities from prayer attitudes on forehead, tip of l ext malleolus patella, tuberosity of l tibia	4. None.
	5. Palm of l. hand and tip of little finger occasionally stained with <i>henna</i>	5 Not so.
	6. Chapkan coat fastened on left side of chest, and may show sunburnt mark	6 Chapkan opens on right side
	7. No sacred thread.	7 Sacred thread in higher castes over left shoulder.
Females.	1. Not tattooed, especially between eyebrows. ¹	1 Tattooed between eyes and inside wrist, especially lower castes
	2. Ears pierced numerous along helix with silver rings	2 Ears pierced in few places.
	3. Nose-ring through septum	3 Nose-rings through loft ala.
	4 Shoe marks probable.	4 Shoes not worn, toes wide-spread
	5 Palm, soles and nails tinted with brown <i>henna</i> or <i>mehendi</i>	5 Stained with carmine <i>aultha</i>
	6. Sari worn double	6 Sari worn single by married, except in E Bengal
	7. Trousers usually ²	7 No trousers
	8. No vermilion or hair-parting	8 Vermilion on hair parting in married.
	9. No iron-wristlet	9 Iron-wristlet on left wrist in married in Bengal

The best test of race is found in the measurements of the head, and of these the easiest to take and one of the most important is the *cephalic index*. This is the ratio between the maximum length and maximum breadth of the skull, thus

$$\frac{\text{Breadth transversely} \times 100}{\text{Antero-posterior length}} = \text{Cephalic Index.}$$

A skull is '*dolicho-cephalic*' or long-headed when this index is between 70 and 74.5, '*meso-cephalic*' from 75 to 79.9, and '*brachy-cephalic*' (the Mongolian type) or short-headed from 80 to 84.9

¹ Except pro-celytized Bengali Mohammedans

² A Parsi woman wears trousers and sacred thread around waist like male Parsis

1068 Sir Win
curve. The acce
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loid notch in the European consists of the transverse ligament alone; the same boundary in the Indian consists of bone (part of the ischium) plus the transverse ligament

Head of the Femur.—The articular area is of greater extent relatively and absolutely than that of an European bone. The surface is specially prolonged to adapt itself to the modified *facies lunata* of the acetabulum during extreme flexion and partial abduction, and during semi-flexion and extreme abduction occurring in the hip-joint in the squatting and satorial postures. The neck of the Femur is longer relatively than in the European. The upper surface of the internal condyle of the femur is partly articular. This is not so in the European, where it is merely rough for the internal head of the gastrocnemius. It is due to the power of extreme flexion possessed by the Oriental knee-joint.

on what is the ligamentous area of the European bone." In upwards of 17 per cent. of tibia a second facet on the same border, but occupying a more internal position, will be seen. Both these articulate with corresponding articular areas on the upper surface of the neck of the Astragalus.

The Astragalus contrasted with the European differs considerably. The

upper surface of the *os calcis* is bounded generally by two sharp non-articular margins. In Oriental bones the outer margin is frequently articular on its inferior aspect, as this part, when the facet exists, articulates with the upper surface of the greater process of the *os calcis*.

The Skull.—For practical purposes it may be assumed that most male Indian skulls, certainly those of the lower castes, have a cubic capacity of 1300 c.c. or under, whereas European male skulls run from 1500 c.c. and upwards. The taken with mustard use of small shot, as dirty].

Bones generally.—Some points assigned by authorities as differentiating European and Asiatic skeletons are to be used with caution :—

1st.—The bones of the Oriental are smaller. It is generally so, but not always. 2nd.—The skeleton of the Oriental is lighter. An adult male European skeleton weighs about 10 lbs. 6 oz., the female weighing 8 lbs. 13 oz. A skeleton of a Panjahi weighing 12 lbs. 3 oz. is exceptional. The rule holds truer for *female* skeletons. An average Panjabi female weighs about 6 lbs. 2 oz. There is a greater difference in weight and stature between the Indian female and the European female than there is between the males of these races.

Birth-mark as Test of Race.—The presence of blue irregular patches on the lower sacral region of infants is alleged by Baelz to be exclusively found amongst persons of Mongolian race. Extensive inquiry by the Indian Government during the census of 1911 elicited that the 'Mongoloid patch' is almost universal amongst the Burmese who are typically Mongolian—the colour is generally dark blue, but varied from dark brown or reddish to pink (Burma Cons. Rept. 1911, 285). It was fairly common in Assam, Bengal, the eastern border of the Upper Provinces and Panjab, where a large leavening of Mongolian blood is known to exist. The Bombay Rept., from observations in maternity hospitals, found the patches in Hindus 25 per cent. in Bombay and 17 out of 19 in Admedabad; Goanese nearly 20 per cent., and infers that while it may be universal in Mongolian races, it is not confined to them exclusively.

Personal Marks or Peculiarities.

These may be *congenital* or *acquired*. Those which admit of being photographed should be so registered.

CONGENITAL.

These are chiefly the features, colour of the eyes, etc., deformities, and finger-prints.

1. **Features.**—Resemblance to parents or family likenesses or to photographic portraits of a missing individual may be important in the case of those claiming to be individuals who have not been heard of for years. In the case of dead bodies, putrefaction rapidly renders the features unrecognizable; in some instances, however, the features have been clearly recognized

eyes, resembled a picture of Pratap. Major Marshall identified him as Pratap by certain marks, though the nose of the young *rāja*, twenty years before, was "rather fuller and smoother, and the outline not so distinct" as the prisoner's at present. The Danish Governor of Chinsurrah, who

The judge held that the case was proved against prisoner and recommended that he be sentenced to three to five years' imprisonment. The High Court (Nizamut) sentenced him to a fine of Rs. 1000 for having assumed the name of Pratap Chandra. He died in obscurity in 1856.—Abridged from *Celebrated Trials*, by J. Goshal, 1902.

(c) Martin Guerre's identity.—In the second half of the sixteenth century, an of twenty, absconded being charged with theft, 'ant son. Martin Guerre, er, and became extremely intimate with a comrade of bad character named Arnauld de Tilh (or Dutille). Eight years after Martin Guerre's disappearance from his home, Arnauld de Tilh appeared there, represented himself as Martin Guerre, and was at once accepted as the latter by all Martin Guerre's relatives, including his wife. The impostor, mainly through his having become acquainted with all the true Martin Guerre's secrets, was able to carry on his imposture with success for several years. At the end of that period a quarrel arose between the impostor and Martin Guerre's uncle, when the latter denounced the former, who was put on his trial. At the trial of 150 witnesses, forty swore that the accused was Martin Guerre, and fifty that he was not; the remaining sixty were in doubt.

even a few words of Martin's native Basque language"—Guy's *F. M.*, 15.

2. Colour of eyes, skin, and hair.—In some individuals one iris differs in colour from the other. The hair resists putrefaction, hence its colour, etc., may be of special importance in the case of exhumed or greatly putrefied bodies. The colour of the hair may, however, have been altered for disguise or otherwise, *e.g.* darkened, generally by the use of metallic dyes, chiefly lead or silver compounds,¹ or rendered lighter by

¹ For the detection of these the hair may be digested in dilute nitric acid, the acid liquid evaporated to dryness, and the usual chemical tests applied to a solution of the residue, or the hair may be incinerated and the metal sought for in the ash (see detection of lead in organic mixtures).

chlorine or hydrogen-dioxide solution, in which case the roots will be found less altered, and therefore darker than the rest of the hair. The hair is frequently dyed reddish in elderly Mohammedans.

Case—A portion of a scalp with a tuft of red hair was held to prove the identity of a murdered indigo planter Dick in Nuddea District in 1830—Chevers, *M J*, 60

3. Deformities.—Such as moles, 'birth-marks' (*nævus*), hare-lip, web-fingers or toes, and additional fingers. Birth-marks may be removed by painting with carbonic-acid-ice; in the inflammation resulting the frozen tissue is absorbed, leaving the skin practically normal.

4 Finger-prints.—Identification by means of finger-prints has now established its claim to trustworthiness, and has become



FIG. 5—Finger-print impressions (after Sir E. Henry)
A, 'plain' B, 'rolled' impression of the same finger

a most important branch of criminal investigation both for the detection of crime and the identification of the criminal. It has, in the Galton-Henry system, been adopted in India, England, and most civilized countries throughout the world, and has superseded the French anthropometric system of ear-measurement of Bertillon, and it is legalized under the Indian Evidence Act, all emigrants signing contracts under the Emigration Act

Finger prints appear to have been first practically utilized for the identification of individuals by Sir W. Herschel, of the Indian Civil Service, who introduced it into the Hugli district of Bengal in 1877 for the purpose of identifying illiterate Indian coolies and the executors of

documents for registration, in order to detect false impersonation, which was prevalent in the law courts.¹ The materials and experience thus gained were utilized by Sir Francis Galton in 1888, in his scientific study of the subject; but it remained for Sir E. Henry (Inspector-General of Police, Bengal) to take up the Galton formulae and invent a relatively simple ideal system of classification on a numerical basis.

The Galton-Henry system is now in general use in India as a check against false impersonation in the case of all subordinate pensioners, civil and military, *pardah* or *zenana* ladies, for medical certificates and attestation in many branches of public business, under the undesirable plague regulations, and for

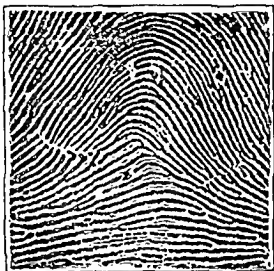


FIG. 6.—Magnified finger print, 'Arch' pattern (after Henry)

N.B.—The white transverse lines across the ridges are cicatrized cuts.

Mohammedan pilgrims to Mecca, to prevent the re-employment of discharged men, and innumerable other purposes of identification. Whilst the record is of admitted efficacy for the proof or disproof of identity where the person in question is accessible or has given his mark on a previous occasion, no objection can be offered to this method on the score of caste or religion, or rank in society or sex, as there is no prejudice to be overcome in obtaining it.

The persistence of the specific details of the ridges forming the patterns of the finger-markings has been proved by Galton to portend throughout the whole period of the individual life. Those found on the new-born babe are traceable on the fingers

¹ *Nature*, XXII, p. 65

of the same person in extreme old age, and are only effaced when decomposition has set in after death. Galton concluded that "there appear to be no bodily characteristics other than deep scars and tattoo-marks comparable in their persistence to these markings."

The characteristic markings on the skin over the balls of the fingers are the curved lines termed *papillary ridges*, not the lines called creases. These ridges are studded with minute pores, the mouths of the ducts of the sweat-glands, which appear on the imprint as fine dotted lines. A cicatrized cut (see Figs. 6 and 7) or deep ulcer leaves a permanent mark,



FIG. 7.—Magnified Finger-print, 'Loop' pattern (after Henry).

N.B.—The white transverse lines across the ridges are cicatrized cuts

which shows on the paper imprint as a white space or line. These marks have to be distinguished from possible accidental creases in unskilful taking of impressions. In comparing impressions the examiner seeks for similarity or dissimilarity in the type and details of the ridges of the patterns; and if his conclusions therefrom are corroborated by coincident creases his task is so much the easier. The lines or papillary ridges are constant and invariable in the same individual, and no two separate individuals exhibit patterns which exactly or entirely correspond. As, however, single digits of different persons have been found to correspond closely in details, great caution is needed where only a single digital imprint is available for comparison,¹ and it is now customary in criminal cases to take

¹ Dr. Gasson, *Trans. Med. Leg. Soc.*, 1906, 16, etc.

the impressions of all the fingers. A 'rolled' impression, recording the pattern of the whole ball of the finger, is much more perfect and desirable than a 'plain' one (see Fig. 5, p. 56), which is only partial.

Directions for Taking Finger-prints.¹—Take (1) ordinary white paper

lens to assist in the counting. The ink, roller and slab must be kept scrupulously clean and free from dust, hairs, or grit, the ink should be kept in a closed bottle, and the roller wrapped in clean, oiled paper, and all old ink wiped off the slab.

For a 'rolled' impression, the bulb of the finger is placed upon the tin slab, over which the *thinnest* possible film of printer's ink has been spread, the plane of the nail being kept at right angles to the plane of the

upon the inked slab, and then impressing it on the paper without any turning movement.

Preparation of Finger-print Exhibits—Crime investigators require to know how to secure the evidence of finger-prints at the scene of crime. A smooth article is likely to retain imprints if touched, whilst a rough surface is of little value. Any finger-print found, which is obviously not

Latent Finger-prints—It is important to warn the police and others not to handle weapons, etc., which might have upon them, if left to skilled hands to examine, valuable silent testimony, as apparently invisible marks may be made visible. *Development of apparently invisible finger-prints*—Dr J. G. Garson's process is to dust an impalpable powder, light or dark, according to the colour of the surface suspected (finely powdered plumbago or grey powder), over the surface supposed to have been unpressed by the papillary ridges of the fingers in their natural state as regards moisture. The powder will adhere to the papillary lines' unpress, and can be examined with a lens, or permanently recorded by photography.²

¹ For full details see *Classification and Uses of Finger-prints*, by Sir E. R. Henry, 4th ed., London 1913, 20, etc.

² *Trans. Med. Leg. Soc.* 11, 1908 p. 115.

















































 <p>OT  IT  Counts 12 149</p>	 <p>OT  IT  Counts 13 150</p>	 <p>OT  IT  Counts 20 151</p>	 <p>OT  IT  Counts 13 152</p>
 <p>OT  IT  Counts 8 153</p>	 <p>OT  IT  Counts 11 154</p>	 <p>OT  IT  Counts 11 155</p>	 <p>OT  IT  Counts 5 156</p>
 <p>OT  IT  Counts 13 157</p>	 <p>OT  IT  Counts 7 158</p>	 <p>OT  IT  Counts 11 159</p>	 <p>OT  IT  Counts 12 160</p>
 <p>OT  IT  Counts 16 161</p>	 <p>OT  IT  Counts 7 162</p>	 <p>OT  IT  Counts 8 163</p>	 <p>OT  IT  Counts 16 164</p>

FIG. 8.—Counting the Ridges (after Henry).

OT = Outer terminus.

IT = Inner terminus.

Classification of Prints for Criminal Work.—This requires the services of a practised expert. The patterns of the papillary ridges fall into

or 'outer terminus,' and the '*point of the core*' or 'inner terminus.' The core of the loop may consist of an even or an uneven number of ridges, termed 'rods,' or the summit of two rods may be joined to form a 'staple.' The arches may be 'tented,' etc., the loops 'pocket,' 'twinned,' etc. The relative frequency of the various patterns is, approximately—Arches 6,

these are recorded on a chessboard-like table with 1024 squares, the number of possible combinations for the digits. The actual formula of each pair of digits is recorded in the form of a fraction, of which the upper letter denotes the pattern of the first digit of the pair, and the lower that of the second digit; thus the right thumb and forefinger becoming respectively a loop and a whorl, is indicated as $\frac{l}{w}$, and a complete formula might be as follows.—

$$\frac{l}{w} \frac{l}{l} \frac{w}{l} \frac{l}{l} \frac{w}{w}$$

which, converted into figures, might be—

$$\frac{0}{16} \frac{0}{0} \frac{4}{0} \frac{0}{0} \frac{1}{1} = 17$$

identified as the appellant, Man Singh. She knew Man Singh, because he was a constant visitor of Durga Pershad. Nothing suspicious was heard that night. In the morning, as no answer could be obtained from Durga Pershad's apartments, the police were sent for, and when they effected an entrance, they found the old man lying dead in his courtyard, which was covered with blood. The body was marked with twenty-four incised wounds. The old man had apparently been first



FIG. 9.—Identification of Bloody Thumb-print in Jalpaiguri Murder Case (after Sir E. Henry).

A, photo-mechanical enlargement of actual blood-print; B, same of thumb-print record in police office; C, same of fresh print; D, diagram of characteristic ridges, enlarged.

attacked in his bed and sitting-room, for the matting on the floor near the bed was drenched with blood. His personal ornaments, etc., were gone,

and ridges plainly marked. The mark was in the exact place it would be

found a long cut, the marks of which were visible at the hearing in the Sessions Court. In addition to the evidence of the Brahman woman, Kalki Chobe identified the appellant as one of the men who constantly used to visit Durga Perahad. Man Singh was accordingly arrested. One of the Muttra police was sent off to Allahabad with a photograph of the impression found on the *lotak*, and with the impressions of the thumb

Justices Blair and Burkitt, in their judgment, remarked: "The witness, who is the head clerk of the Criminal Identification Department,

(b) **Bloody thumb-print in murder case.**—In 1889 the manager of a tea garden in the Jalpaiguri district was found lying on his bed with his throat cut, his despatch box and safe having been rifled, and several hundred rupees carried away. Amongst the papers found remaining

(see
It
"

imprisoned for theft, and who had been released from jail some weeks before. He, in consequence, was arrested in Birbhum, a district some hundred of miles away, and brought to Calcutta, where his right-thumb impression (C) was again taken. D shows the ridge characteristics relied on in the identification. The Chemical Examiner certified that the brown marks on the calendar were mammalian blood, the inference being that the murderer or his associate gripped the calendar with his blood-

(c) The Deptford case.—In 1905 a man and his wife were murdered in their bed at a house in Deptford, London. They were in the habit of placing their money each night in a small cash-box kept under a pillow

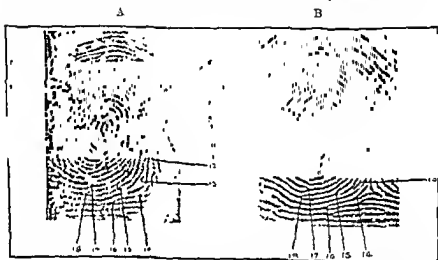


FIG. 10—A, Photographic enlargement of mark on glass; B, Photographic enlargement of an imprint of the right forefinger of John McDermott. The characteristic points are numbered similarly in both figures (after Henry).

of the bed. After the murders the cash-box was found in the bedroom
tray was a

ested on sus-
locality about
s were taken,
to be identical

finger-print evidence was most valuable. house of care it. The

They were convicted of the murders, and executed.—*Times*, May 8, 1905.

Forgery of thumb-print signatures.—It is not difficult to forge thumb-prints, as Major H. Smith, I.M.S., has shown, by covering the

original thumb impression with a damped paper and pressing, by which method the reverse of the original is transferred to the damped paper, and another piece of damped paper is then put over the reverse and pressed, when a true copy of the original adheres to the paper.

Foot-prints of Babies.—To prevent the crime of changeling or deliberate substitution of babies, or the accidental changing of babies by confusion in maternity hospitals, the system is now introduced of taking as a precautionary measure an impress of the babe's footprint, which thus forms a permanent life-record of identity.

can be cleaned off the foot with alcohol. Care must be taken not to disturb the impressions before they are dry. There will then exist for all time a record of the baby's identity which would carry weight in any court of law in after years. No matter how much the feet grow, the lines will have grown with them, and their pattern will not be changed.

Bertillon's measurements of the ear and certain bony points which do not vary between adolescence and old age are specially used for the detection of criminals, but being more difficult to make, and varying so much with the personal equation of different operators, the use of this system has been given up by the police in India in favour of the finger-print system. The ear measurements are obviously useless in so many tribes which distort their ears by plugs and heavy rings, and in the thickening of leprosy.

Acquired Peculiarities.

1. **General condition of body.**—Fat and muscular or the reverse, baldness, etc.

2. **Scars and traces of old injuries.**—Scars by wounds, burns, and ulcers (syphilitic and other) tend to contract and become more linear in time, but being less vascular than the rest of skin, they are rendered more visible by friction. If necessary a lens should be used. Their number, situation, size, whether adherent, depressed, etc., should be noted—the size should be measured with compasses. A scar is inevitable after a wound, but where there is little loss of tissue and no suppuration, the scar may be slight. Small linear scars may disappear in time. Casper notes that the linear scars of cupping disappeared in three years. Large scars never disappear, and those of burns, scalds, and crushed wounds are more permanent than those of incised wounds. No scar can be

artificially removed. It is very difficult to swear to the age of a scar, some remain red and vascular after many years.

Old fractures and ununited fractures may enable the identity to be established. The body of Livingstone, the great African explorer, was identified by an ununited fracture of the humerus due to the bite of a lion. In case of *Hanbil v. Nazzer Khan*,¹ identity was established by a peculiarity in the jaw-bone.

Case—A Bengali impostor pretended he was a native gentleman whose death and consignment to the Ganges some years before was plainly proved. He denied the former fact and alleged that after being thrown into the river he revived. Medical evidence exposed the imposition by proving that part of the body of the deceased had been eaten away by an incurable disease.²

3. Tattoo-marks.—Unlike scars which are the result of accident or disease and located variously, tattoo-marks are the result of deliberate choice and often by the same operator, so that the same design may be reproduced exactly in the same situation on more than one individual. The pigment generally used in India is black or blue, but in Burma red is also extensively used. Pigments consisting of vermilion and ultramarine disappear more readily than Indian ink, soot, gunpowder, or carbon in other forms, which latter, according to Tidy, never disappear if inserted properly below the epidermis. The shortest time in which non-carbonaceous marks disappear is agreed to be ten years. Tattoo-marks cannot be removed unless the skin is destroyed, in which case a scar would remain. The claimant in the Trehborne case (p. 54) had a scar where it was sworn Arthur Orton had been tattooed. Faded tattoo-marks are made more distinct by strong friction.

4. Loss of teeth and artificial teeth.—Loss or deformity of teeth and presence of false teeth or correspondence of the jaw with a mould taken by a dentist for the purpose of fitting artificial teeth may be important in establishing identity (see Parkman's case, p. 68). The body of the Raja of Benares, who was slain in battle by Kuttub in 589 of the Hijra, was recognized among heaps of the slain by its artificial teeth, which were fixed in by golden wires and wedges.³ A bite may show certain teeth missing; and so identify the biter.

5. Occupation marks.—Hands horny or otherwise; stains in hands of dyers, photographers, and painters, needle-pricked fingers in tailors, etc.; this is chiefly useful in unknown dead bodies.

¹ 3 N. & D. 15 pt., 122 Chivers, 43.

² Dow's *Hindustan*, I, 145.

³ Chivers, 100.

6. **Memory of past events.**—This is often of great importance in cases of imposture, see Tichborne case, p. 54.

7. **Handwriting, speech and voice, gait, tricks of manner, etc.**

8. **Clothes and jewelry, viz., ring, watch, visiting card, letter, etc.** These are only of very secondary importance, as they are easily changed, for characteristic differences of native dress, see p. 59.

Light sufficient for Identification.

A flash of lightning undoubtedly affords sufficient light to enable an individual to so distinctly discern the features, etc., of another, as to be able to subsequently recognize him. The flash caused by the discharge of a pistol or gun, provided the circumstances are favourable, also similarly affords sufficient light for recognition and identification. Favouring circumstances are: close proximity to the discharge on one side of the line of fire; absence of other light; and not much smoke from the powder.

Identification of Fragmentary Remains or Bones only.

The first thing to determine is whether the fragmentary remains are human or not. Then you note which side of the body or limb they belong to and try to fit the fragments together; noting the means by which the fragments have been separated, whether cut, or broken or torn asunder or merely grazed by dogs, jackals or other beasts or birds of prey. The state of decomposition of the soft parts may give a clue to the length of time elapsed since death. If vital organs are present, note whether they bear marks of injury likely to have caused death.

Where *bones only* are available it is desirable to record the details of the several bones individually (see Fig. 1, p. 39), for reference and proof of age, stature, etc. Any malformations should be specially noted. The odour of recent bones should be noted for the time of death. The odour of bones cleaned by ants, etc., is very different from that of old bones cleaned by decomposition in the earth.

“Professor A. Powell has upset a romantic police theory of murder by finding the nutrient canals of a skeleton filled

with red wax containing much arsenic. He concluded the bones had come from a dissecting room."

In another case the skin from the lower part of the abdomen showed a linear operation scar with only two transverse stitch marks—one at either end. This suggested the operation had been performed by an American surgeon who used a continuous suture so that all the loops, except the first and last, remained buried below the surface. This fact led to the identification of the body.

Cases —(a) C.

Bankura in 1833

was beaten a few rib. The only bone produced in court was a rib, this had been broken but had osseous callus around both fractured ends, from which the civil surgeon was of opinion that the fracture must have occurred at least seven or eight days before death. The body in question was disinterred three months after the death of Meah Khan and the bones were found clean and free from periosteum, ligament, and cartilage, which the civil surgeon considered rendered it extremely improbable that the bones were those of a person who had died three months previously. Dr. Chevers, however, considered that mere cleanness of the bones could be accomplished by natural decomposition if exposed to the ravages of multitudes of ants and insects, the odour, however, of a recent bone thus rapidly cleaned by insects would in no way resemble that of one which had gradually undergone denudation underground.

(b) *Dr. Parkman's case* —Dr. Parkman, of Boston, U S, was last seen alive entering the medical institution in which Dr Webster was a lecturer on chemistry. excited, search was made of a human body dis left leg, were found, Among the ashes in blocks of mineral tea of the chief points in

(2) The pelvis was clearly that of a male. (3) The parts of the body were free from all traces of the preservative fluids always employed in

was found to fit exactly a cast of Dr. Parkman's jaw, which had a short time before been taken by a dentist who had supplied Dr. Parkman with artificial teeth, similar to those found in the furnace ashes. Dr. Webster was convicted, and subsequently confessed that he had murdered Dr. Parkman.—Guy, P. M., 32.

(c) *Careless identification of bones.*—A married woman and her child, a girl aged four or five, disappeared at Mierut, under circumstances

pointing to their having been murdered by a man named Kulloo, the woman's paramour. Kulloo absconded, but was subsequently apprehended while trying to sell ornaments proved to have belonged to the missing woman. Kulloo, when apprehended, made contradictory statements accusing other parties of the murder, and ultimately led the police to a place where several human bones were found, among them portions of two skulls, one small, the other larger. Among the fragments of the larger skull was an entire upper jaw (and half a lower jaw) with the teeth attached, and, near the bones, clothes, identified as having been worn by the child, were found. The civil assistant-surgeon, to whom the bones were sent, reported the bones to be those of two children, one about eight years, the other about eight months old. On this Kulloo was convicted of theft only. A re-inquiry was ordered, and at the trial held fourteen months afterwards, the civil surgeon was of opinion that the assistant surgeon had mistaken the bones of a small adult female for

(d) **Teeth and cartilage-tumour.**—(i) Identity of body was established by absence of left lateral incisor and by hair on back of head. Prisoner convicted. (ii) Remains of cartilaginous tumour of the neck in a body almost skeletonized led to identification.—*Ind. Med. Gaz.*, January, 1875

The **Stature** may be approximately fixed by laying out the skeletal bones and allowing 1½ inches for the soft parts. If the femur is not found, the width of the two arms abducted from the trunk gives the 'fathom,' which nearly coincides with the height.

For estimating the stature from one cylindrical bone, Orfila gives a table which may err to the extent of over 4 inches. Tidy gives the following data in percentages of height.

Humerus from 17·4 to 19·5; radius, 13·2 to 14·5; femur, 22·6 to 27·51; tibia, 18·5 to 22·15; spine, 36·8 to 31·54

To the above is added 1 to 1½ inches for the soft parts of sole of foot and the scalp the variation, however, is too great to be of much service. In a dry skull with a hole in it of an alleged fracture, note if the hole is due merely to the falling in of an os triquetrum (when its margins will be jagged) or to a true fracture.

Even when identification is not established the death-sentence may yet be passed.

Case (c) *Dead body found in a well.*—*Reg. v.*
to leave his village
On the way he was
—“his skull in three

or four places, grey hairs, a pair of shoes, and a bag with dirt and steel. The jackals, vultures, etc., had nearly picked the bones clean.” There

was circumstantial evidence, and the sentence was—death to first prisoner.
—*Madras Reports of Foujdaree Udaltut*, 1859

(b) **Non-identified remains.**—*Reg v. Mahābalaya*.—Deceased was a Brahman, who had been sent to cash a cheque on a Friday, and did not return, and on the following Wednesday the remains of a man, with a Brahmanical thread, were found “The witnesses could not identify the body, as the features were entirely decomposed” Some clothes near the body were identified, and certain persons who had been last seen with deceased were, on the strength of circumstantial evidence, convicted. The sessions judge recommended transportation for life, because the body had not been clearly identified, but the High Court (Foujdaree Udaltut), seeing no reason to doubt that the remains were those of the missing man, sentenced to death—*Madras Reports of Foujdaree Udaltut*, 1859. Honore, June, 1859

CHAPTER II.

EXAMINATION OF THE LIVING PERSON,

THIS is usually much simpler than the examination of the dead in criminal cases, as it is often little more than a mere matter of surgical diagnosis. The medical expert should be furnished by the police or others with a note for his guidance, identifying the person and detailing every known circumstance of importance in the case on which his examination and opinion are required. This should be sent along with the person who is to be examined. In practice, the information thus sent to India is generally meagre and omits points of critical importance, and often it is untrustworthy and occasionally false.

you ask 'leading' questions or those which suggest the particular answer

Your examination in some cases, such as rape, may extend to besides (1) the person of the victim, and (2) the accused, also to (3) site of the alleged offence, and to (4) stained clothes, weapons, or other articles submitted to you for examination.

The Exhibits, as these latter objects are termed, should, after examination, be carefully preserved by you as evidence, and should, whilst in your custody, be carefully sealed up by yourself and locked away to prevent their being tampered with. If sent to the Chemical Examiner, they should be duly labelled, attested, and sealed with your personal seal, of which an impression may accompany your letter to that officer (see detailed 'Directions' in Appendix IV). Where there is more than one exhibit, each should be marked by a distinctive letter or number.

As the alleged cause of injury is not always the *true* cause, it is necessary for you to consider other possible causes than that which may be specified in the indictment.

*you
can
take*

condition he was immediately taken before the doctor. He was made to vomit, and brought up a quantity of Datura seeds, which he had taken in a fit of passion after a love quarrel. Now, if this circumstance had occurred away from the station, and the man had died, the body would have been sent in with the remark "said to have died from the

abortion, or insanity, should include the points noted in Appendix I. G—J, as well as those under those respective articles.

The Report Certificate of the results of your examination should invariably be prepared from your recorded notes with the utmost care and scrupulous precision, never perfunctorily. *Write legibly* and use in mentioning a disease the 'Nomenclature of Diseases.' *Never sign a certificate blank*, leaving the details to be filled in by an assistant. Where formal certificates are called for, read carefully the printed instructions and *refresh your memory each time* you write a certificate. For death-certificate, see p. 98.

CHAPTER III.

EXAMINATION OF THE DEAD BODY.

THE medico-legal examination of a dead body for an inquest or other inquiry is one of the most important duties of civil surgeons and police-surgeons, and for its proper performance the most expert and experienced pathologist available should be employed.

Legal Necessity for the Examination.

The object of the examination is to ascertain the cause and manner of death in all deaths from violence, or in sudden deaths from unknown causes, and in those suspicious cases in which the medical attendant is unable or refuses to give a death-certificate (see p. 98). In such cases it is not otherwise possible to exclude death from criminal violence even when unsuspected in death occurring apparently from 'natural causes.' For it is not uncommon to find that cases of apparently natural death without any external mark or wound on *post-mortem* examination prove to be cases of fatal poisoning, or fracture of the skull or ribs, rupture of internal organs, etc. See cases under-noted.

externally to indicate the nature of the case.—Sir H. H. Littlejohn, *Trans. Med. Leg. Soc.*, I., 1902, p. 16.

poisoning by prussic acid, probably suicidal.—Sir H. H. Littlejohn, *Trans. Med. Leg. Soc.*, I., 1902, p. 16.

(c) An old of the body, to have died from subsequently found to have shot himself there was no external evidence of the cause of death, no alteration of features, no effusion of blood, and no weapon found until some days after the event.—Sir H. H. Littlejohn, *Trans Med. Leg. Soc.* I, 1902, p. 17.

The body of a murdered person must as a rule be produced, be identified, and be examined, in order to warrant a conviction in law and even a trial. The many facilities for destroying dead bodies in India (see p 16), affords the criminal in this country unusual opportunities for destroying this important part of the evidence of his guilt¹

On the other hand, the sentence of death was confirmed in a case in 1901, where the body was never found—

Case—Death Sentence when body not found.—The appeal of Sheo-mangar Singh, the Raipuri Zemindar, who was convicted of the murder of a woman and sentenced to death by Mr. Stuart, Acting Session

ships, in the course more satisfactorily brutality. The conclusion of this only sentence of death.—*Pioneer Mail*, July 12, 1901.

Method of Examination.

First the dead person is to be *identified* and then the *Cause of Death* is to be ascertained. Before beginning the examination it is advisable that the examiner be informed regarding all the circumstances of the death as far as is known; whether any violence was received or any known disease or condition which may have contributed to the death. Otherwise certain questions may be raised at the trial which the examiner may be unable to answer through not having his attention specially directed to them. Begin your **notes** by recording the exact date and hour, place, when and where the examination is made, and how the body was identified.

¹ "According to Indian law, as administered by the Nizamut Adawlat, the finding of the body is not indispensably necessary to warrant even a capital sentence; but, in such cases, an irrevocable sentence is not usually passed." (Goodeve, in *Beaufort's Digest*, 1857, Homicide and Murder, Index C. s. 3930.) Goodeve here cites the case of *Kanlal v. Chundwa* (2 Niz. Ad. Repts 82), bones were found, but these not being identified the court withheld the capital sentence, notwithstanding a confession, and in one of *Hanlal v. Nuzer Khan* (3 Niz. Ad. Repts 122), the result was the same notwithstanding the recognition of the skull by a peculiarity in the jaw-bone.—Chevers, *M*, 48.

The **Identification** when the body is found not long after death can be easily made by some one who knew the deceased intimately. But if putrefaction has set in, or an accident has disfigured or destroyed the features, or only a skeleton be left, the identification should be made by the medical expert in the manner already described (p. 34), for sex, age, state of teeth and jaws, height, general condition, colour of eyes and hair, whether any part denuded of hair, deformities, tumour, old scars, tattoo, perforations for nose and ear-rings; and everything distinctive in the way of dress, a ring, watch, letter or card, artificial teeth, sample of hair, etc., should be kept as evidence by the

is that of some unknown

In a skeleton, the follow-

(1) whether the bones are human or animal, (2) sex, (3) height, (4) age, (5) race, (6) deformities or signs of previous injuries, (7) position in which bones are lying, and (8) probable length of time they have been buried or lying.

The **Cause of Death** in suspected criminal cases is sought for by (1) Inspection of the position, attitude and surroundings of the body on the spot where it was found before removal; (2) External examination of the body itself and its clothes and coverings (p. 76); (3) Internal *post-mortem* examination (p. 95).

I. Position, Attitude, and Surroundings of Body.

If summoned to the spot where the dead body has been found and is still lying, note carefully before removing the body or displacing its clothes:—

1. **Attitude of body and position relative to surrounding objects.** Note whether the body is lying on the ground or floor, or is lying on a bed, couch, or other article of furniture, or is seated or supported in a semi erect or erect attitude, and, if so, how supported, or is suspended partly or completely by a ligature round the neck, etc., etc. Note the attitude of the limbs, and the position of the body in regard to surrounding objects; for example, whether the body is lying at the foot of a precipice, tree, or other high object from which it may have fallen, or is immersed wholly or partly in water, or is lying in a room, and if so, in what part of the room, etc., etc. Photographs for these and other conditions are desirable.

2. **Nature, condition, and position of objects in contact with or lying near body.** Note if any objects are lying loosely in, or are tightly grasped by, the hands (not merely gluing by

clotted blood); and if so, their nature and condition. Note any marks of jetting or spotting of blood on the walls, etc.—their presence indicates the person was still alive where found. Note the position, nature, and condition of any ligature on the body, and the exact situation of the knot, whether or not any stains of blood, vomit, etc., are present on or near the body, on floor, walls, doors, windows, or furniture, or any finger or footmarks, and whether any weapon or any vessel likely to have contained poison is lying near it, preserving such weapon, vessel, etc., for further examination. Note whether any confusion in the furniture or other signs exist in the neighbourhood of the body indicative of a struggle having taken place, or of the employment of weapons, or generally of the presence of persons other than the deceased, at the spot about the time of infliction of the injury.

Although examination of the spot where a dead body has been found and of the position of the body in regard to surrounding objects, often affords valuable information as to the circumstances under which death occurred (see cases of 'Wounds'), it must be recollected, however, that the spot where the body has been found may not be the place at which the act was done which caused death. In such a case the question will arise: What power of locomotion remained to the deceased after the act was done which caused his death, and was this sufficient to enable him to move from this spot at which the act was done, to that where the body was found? The answer to this question may, it is evident, have an important bearing on the question: Was death due to homicide, suicide, or accident?

II. External Examination of the Dead Body.

Before det.
it is desirable:
two questions
has the person been dead?

Death Modes.—By 'death' of the body is popularly meant '*somatic*' (as opposed to '*molecular*'²) death, i.e. the total extinction of the vital activity of the entire body which is kept going by the heart and lungs acting under the control of the

¹ See 'Wounds,' Chap. VI.

² '*Molecular*' death of the individual tissues and cells of the body does not occur till some time after somatic death.

brain. Hence it is usual, following Bichat's arbitrary classification, to speak of **three Modes of Death**, according to whether death begins in one or other of these three organs respectively, irrespective of whatever the remote cause of the death may be:—(1) syncope (death in heart); (2) asphyxia (in lungs); (3) coma (in brain).

A more practical view and more in keeping with the facts is that formulated by Professor Powell for the assistance of medical practitioners in doubt whether to certify the cause of death as coma, syncope, or shock. He writes: "Even in cases of gross lesions of heart or brain, death in 'inhibition,' 'shock,' or 'syncope' arises from a paralysis, a failure of the heart muscle to contract. Immediately after death owing to failure to act—to contract—the heart is in diastole. Nature abhors a vacuum, therefore both sides of the heart are usually full shortly after death from inhibition.

"Later, when *rigor mortis* sets in, the heart, like the other muscles, becomes rigid, contracts and expels the blood from its cavities. If the autopsy take place now, Bichat's empty heart

"Hence in death from syncope the *post-mortem* signs vary according to the time at which the autopsy is made

"1st Stage.—Heart in diastole, flabby, both sides distended.

"2nd Stage.—In *rigor mortis*, both sides contracted and empty.

"3rd Stage.—In decomposition the right side, except in cases of hæmorrhage or perforation of the abdomen or thorax, will be full.

"After death from asphyxia, the pulmonary vessels being full, the contraction of *rigor mortis* is insufficient to empty the right ventricle."

Post-mortem signs of these modes of death are:—

system than in coma, and the lungs may show apoplectic changes and their substance with patches of superficial emphysema and sub-plural ecchymosis or Tardieu's spots (see 'Asphyxia'). In some cases of sudden

death the most careful examination fails to find any of these positive lesions. In such cases it may be that death occurred by the sudden stoppage of the heart by violent emotion.

Signs of Death.

The fact of actual death is ordinarily ascertained with little difficulty. The most patent and positive sign of death is the commencement of general putrefaction of the body, which takes place some time after death. But a considerable time before putrefaction has set in, the fact of death is occasionally the subject of some doubt. Cases have occurred in which persons in a state of deep trance or catalepsy have been supposed to be dead and been *buried alive* (see below). It is well, therefore, never to give a death certificate, or think of opening the body until you make quite certain that the body is actually dead as detailed in 'Signs of Death' (p. 81), and 'Apparent Death and Death-trance' (see below).

Simulated death for purposes of extortion is easily detected by pricking with a pin or by the application of a flame or the actual cautery to the skin, or insertion of cayenne into the conjunctiva.

Apparent Death, Death-trance, and Premature Cremation or Burial.

The tragic possibility of cremating or burying live persons is in India a very real danger, in view of the hurried disposal of bodies within a few hours after apparent death, owing to climatic reasons, and the want of sufficient medical examination. Even in Europe, where a long interval of several days intervenes, numerous authentic cases are recorded of people being buried alive or rescued by accident on the verge of the grave. In India many cases also are reported,¹ and there is reason to believe that this practice is not altogether infrequent. Such individuals rescued from the funeral pyre usually lose their caste, and pyre attendants have admitted that when bodies show signs of animation they stuff mud into the mouth and nostrils of the body in the belief that the movements are the work of evil spirits. Suspended animation may possibly occur not merely

¹ *Indian Jour. Med. and Phys. Science*, 1836, I, 389; *Calcutta Jour. Med.*, 1860, II., 303; W. Tubb, *Premature Burial*, London, 1826, pp. 60-63, 90, 91, 115, etc.

in the rare instance of lethargic stupor and catalepsy, but in the commoner acute diseases, cholera, fever, sunstroke, and other nervous affections, traumatic concussion, tetanus, 'teething' convulsions, lightning-stroke, drowning, chloroform-poisoning, collapse after child-birth, in still-born infants. In such cases, where there is the slightest doubt of actual death, artificial respiration and other restoratives should be assiduously practised; *even when the circulation and respiration have apparently ceased.* In the case of infants these attempts to restore the possibly latent life should be persisted in for several hours (see cases below), and in no case should one single 'sign' of death short of putrefaction be relied on. The salutary British military rule which compels a *post-mortem* examination on every soldier, *not earlier than twelve hours* after disease, is a safeguard that should be made of universal application in India. In 'death-trance' where no sign of vitality can be recognized, the presence of life may be ascertained, (1) by the absence of any sign of decomposition, (2) by en by the
ability of
in about

three hours after actual death.

London, 1896, p. 80.

Case.—Yogi's Ecstatic Trance.—In Delhi in 1899, Dr. H. C. Sen and his brother, Mr. Chandra Sen, Municipal Secretary, examined a well-known Yogi devotee in a self-induced trance in which he appears to have been seated cross-legged in Buddha-fashion. They found that the pulse had ceased to beat altogether, nor could the slightest heart-beat be detected by the stethoscope. The Yogi was placed in a small subterraneous masonry cell and the door locked and sealed by the city magistrate. At the ex-
and the devotee found
appearance, the limbs
brought from the vault
the body massaged with oil and in three days was
returned. He was fed with a spoonful of milk, and in three days was
able to eat his normal diet, and was alive seven years after.—W. Tebb,
Premature Burial, 1896, pp. 44, 45.

four hours after they had been left as dead

The exact moment of death (*i.e.* somatic death) is sometimes of importance not only in cases of suspected foul play (see *Onset of Cadaveric Changes*, p. 85), but in successorship, where it is necessary to prove that a child was or was not born before the death of a testator, as a will takes effect from the moment of the death of the testator, and not from the date of finding or proving the will.

Legal presumption of death—In India the law is (a) that if a person is proved to have been alive within thirty years, the legal presumption is that he is still alive, except (b) it is proved that the person has not been heard of for seven years by those who would naturally have heard of him if he had been alive, in which case the law presumes that he is dead (ss 107 and 108, I. Ev. Act). The law, however, presumes nothing as to the time of his death, the period of which, if material (as it often must be in cases of succession and inheritance), must be proved by evidence. In either case the presumption arising may be rebutted by proof, in case (a) of the person's death; in case (b) of his being still alive. In France, a legal presumption of death arises after thirty-five years of absence, or after one hundred years from date of birth.

Question of presumption of Survivorship.—When two or more persons die at almost the same time, or by a common accident, the question may arise who survived longest; and if no direct evidence on this point is available the question becomes one of presumption of

him by A. In some countries definite rules of law exist by which such cases are decided. In France, for example, some of the rules laid down are (1) If all those who perished together were under fifteen, the oldest

faint than males, and as the occurrence of syncope delays death by asphyxia, it is possible that females may survive longer than males. If, however, there has been a struggle for life, it is probable that the males,

being stronger, survived the females. (4) Where the cause of death is starvation, aged persons (if healthy and robust), requiring less food than adults and children, probably live longest.

The chief Signs of Death are —

1. **Cessation of Circulation**, complete and continuous.—The entire cessation of the circulation for over five minutes is usually in itself evidence of death. In cases of fainting and prolonged typhoid of low type, and 'suspended animation' the heart may cease to beat for several seconds, and in newly born infants and in the apparently drowned may cease for ten or fifteen minutes, but continuous and complete cessation means death. M. Rayer, from observations on the dying, assigned seven seconds as the maximum interval observed between the last two pulsations of the heart. Tidy (*Leg. Med.*, I. p. 138) quotes a case of a man aged 33, where for eight minutes no heart sounds could be detected, the man ultimately recovering.

Suspended Animation under Anaesthetic.

Case.—Child resuscitated after Heart had stopped for thirteen

minutes."—*Guy's Hospital Magazine*, 1916.

Suspended animation—Voluntary.—Cases are recorded of persons who have apparently possessed the power of voluntarily suspending the action of the heart.

Cases —(a) Case of Colonel Townshend, quoted from Cheyne (Guy, old us that he had sensation he had for as that, composing yet by an effort or s he had sometimes s pulse first; it was d its usual beating. posture some time; while I held his right hand, Dr. Baynard laid his hand on his heart, and Mr. Shrine held a clean looking-glass to his mouth. I found his pulse sink gradually, till at last I could not feel any by the most exact and nice touch. Dr. Baynard could not feel the least motion in his heart, nor Mr. Shrine discern the least soil of breath on the bright mirror he held to his mouth. Then each of us by turns examined his arm, heart, and breath, but could not by the nicest scrutiny discover the least symptom

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I return herewith

"Medical Jurisprudence."

Thank you very much.

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29 May.

the temperature of surrounding objects, lower in temperature if takes place.

o temperature of the than the normal, and a cases of death from Wright's disease, abscess of the nervous system o, amounting in some semical changes in the cases due doubtless to in India ranges from the air and surrounding n more in the summer as far as is possible. • mortis setting in at a 1. The average rate of 7 the first three hours, o Europe a dead body in-tropical India much gh far fewer degrees of and its surroundings. i the cause of death. es to burn after death. 2. (4) Stillness of air children and the aged 3 of body by non-con- stened by (1) Chronic ess of air. (4) Access ne youth or old age. Immersion in water,

ation.'—This post-fluid blood sinking adent parts of the death (3 to 4 Tidy. it, and calves as a tion indistinguish- a long before death: tasis in morphine rs before death.

uous of a bruise by nt part of the body. margins are sharply sion into it does not mple staining. This s far advanced.

of life in him. This continued about half an hour. As we were going away (thinking him dead) we observed some motion about the body, and upon examination found his pulse and the motion of his heart gradually returning, he began to breathe gently and speak softly." Col. Townshend died the same evening, and on *post-mortem* examination all the viscera were found healthy except the kidneys, for disease of which he had been long under treatment.

(b) Dr. Duncan, Edinburgh, mentions the case of "a medical student who, like Col. Townshend, simulated successfully the appearance of death, he died, however, some time afterwards of disease of the heart"—Ogston, *Med. Jur. Lect.*, 364.

(c) Heat or a blister on skin will not produce a true vesicle with red margins on a dead body. (See 'Burns.')

2. Cessation of respiration, complete and continuous.—Three and a half minutes is considered the extreme limit during which respiration may absolutely cease and life be maintained. In divers and in Cheyne-Stokes respiration, two and one minutes respectively are the probable limits. In newly born children life has been known to continue for a considerable period without respiratory movements being apparent, and occasionally in older individuals.

Tests:—(a) A cool bright looking glass held in front of the mouth will be dimmed by the moisture of the breath if respiration is going on.
(b) A feather held over nostrils will move if respiration is continuing.
(c) A shallow vessel of water or mercury placed on the chest will show movement in its reflection of a spot of light from its surface if there be movement of the chest walls.

Case.—**Suspended respiration.**—Professor Maschka, of Prague, related in his lectures that a "mature child, which showed no signs of life, was placed in the anatomical rooms of the university, left there for fourteen hours, and then taken to the physiology classroom. On laying open the chest, no blood flowed from the integuments and soft parts in front. When the heart was reached, it was seen pulsating at the rate of twenty beats per minute. The lungs were seen to be in the fatal condition."—Ogston, *Med. Jur.*, 365.

3. Changes in the eye, e.g. loss of sensibility of the pupil, loss of transparency of the cornea, loss of tension of the eyeball. None of these are reliable. The pupil may for a short time after death still respond to the action of atropia; and loss of transparency of the cornea, and of tension of the eyeball, may occur during life.

4. **Cooling of the body.**—After death the temperature of the body tends to fall to that of the surrounding objects, and if these, as is usually the case, are lower in temperature than the body, a gradual cooling of the body takes place.

In death from certain diseases, however, the temperature of the body may, at the time of death, be higher than the normal, and may even rise considerably after death. Thus in cases of death from yellow fever, cholera, small pox, rheumatic fever, Bright's disease, abscess and injuries of the nervous system temperature, amounting in some cases to 104° F., is observed, owing to chemical changes in the molecular life of the tissues, and partly in some cases due doubtless to microbic activity. The normal body temperature in India ranges from 97° F. to 99° F., whilst the mean temperature of the air and surrounding objects in India is frequently 90° to 97° F., or even more in the summer and autumn. Hence a body may rapidly 'cool' as far as is possible under these circumstances, and so permit of *rigor mortis* setting in at a very much earlier period than in temperate Europe. The average rate of cooling in a temperate climate is about 4° F. during the first three hours, and afterwards about 1° F. per hour. In temperate Europe a dead body

(6) Exposure of body without coverings. (7) Immersion in water, especially running water.

5. **Cadaveric hypostasis, or 'Sugillation.'**—This *post-mortem* staining of the skin is due to the fluid blood sinking under the effect of gravity to the most dependent parts of the body. It begins to appear a few hours after death (3 to 4 Tidy, 4 to 12 Mann), first at back of neck, chest, and calves as a dusky red discoloration. Hypostatic congestion indistinguishable from *post-mortem* sugillation may set in *long before death*: Professor Powell has seen striking hypostasis in morphine poisoning, in plague, and in cholera two hours before death.

It can be distinguished from the true ecchymosis of a bruise by observing that (1) it is only in the most dependent part of the body, (2) it is not elevated above general level, (3) its margins are sharply defined, (4) its surface is not abraded, (5) an incision into it does not show clotted blood outside the vessels but simple staining. This distinction can be made even when decomposition is far advanced.

¹ Tidy, *Leg. Med.*, I. 46.

² Waddell, *L. A., Ind. Med. Gaz.*, 1884.

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se of "a medical fully the appearance of disease of the

ceased.—(a) **Pulse.**—ble at the wrist, be in their distribution. very feeble pulsation If any circulation is) **Open small artery,** heart is not beating. true vesicle with red

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is cold in from eight to ten hours. In tropical or sub-tropical India much

less time is required, as the body has to cool through far fewer degrees of

temperature to reach the temperature of the air and its surroundings.

Loss of heat is delayed by (1) Acute fever, as the cause of death,

(2) Sudden death, as the nutrient material continues to burn after death,

(3) High temperature of surrounding air or water. (4) Stillness of air

lk. Bodies of children and the aged

(6) Covering of body by non-con-

heat. It is hastened by (1) Chronic

h. (3) Coldness of air. (4) Access

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Cases — (a) **Hypostasis** mistaken for marks of injury *Emp. v. Falkhytter*, Cachar Sessions, 1898. Lt.-Col. Borah, I.M.S., deposed that "on 11.1.1901 at 1.30 p.m. I saw the back of the buttocks,

tusions. Accused was acquitted."

the trial, Drs Bell and Fyfe proved, to the satisfaction of the court, that the apparer hypostasis, many kinds

See *Bain* Case in Appendix.

6. Cadaveric rigidity, or Rigor Mortis.—This stiffening, which occurs after the body has become 'cold,' is due to changes in the muscles on their molecular death. After somatic death, the muscles pass through three stages, namely, 1st, relaxed with contractility; 2nd, rigid and non-contractile—the *rigor mortis* stage; and 3rd, relaxed with incipient decomposition

In the 1st stage the muscles are relaxed, but contract on the application of stimuli. This stage in exceptional cases may last only a few minutes, or even be absent, as in the case of soldiers killed in battle clutching their guns or swords, and pistols or knives grasped in the hands of suicides.—this form has been called cadaveric spasm (see p. 87).

trance").

In the 2nd stage, that of cadaveric rigidity, or *rigor mortis* proper, the muscles become rigid, partly from coagulation of myosin. All

The time of onset of cadaveric changes in India is different from in Europe.—As the time of onset of the cadaveric changes is of great importance in fixing the time of death, and there were no data on record for India, Dr. Mackenzie undertook

in 1883, a series of observations to ascertain these points, the results of which are here summarized.

SUMMARY OF ONSET OF CADAVERIC CHANGES IN INDIA¹

Changes	Average		Earliest.		Latest.		Average for October of 10 cases	
	hrs	min.	hrs	min	hrs	min	hrs	min
Muscular irritability lasts from death	1	51	0	30	4	30	1	42
Rigor mortis begins .. .	1	56	0	30	7	0	1	10
" " duration	19	12	3	0	40	0	31	30
Green discoloration appears	26	4	7	10	41	0	24	16
Ora of flies appear .. .	25	57	3	20	41	30	—	—
Moving maggots appear	39	43	24	18	76	0	81	21
Vesications appear .. .	49	34	35	0	72	0	59	8
Evolution of gases	18	17	5	50	34	30	29	17

The changes were observed in the bodies of persons dying in hospital in Calcutta mostly from chronic diseases.⁴ Thirty-six cases were examined between July and September with an average aerial temperature of 85·5° F., and 10 cases in October with an average air temperature of 81·8° F. It will be seen that, as was to be expected, the data differ considerably from those made by Casper in Berlin and by other observers in Europe—the changes generally occurring considerably earlier in India owing to the heat and humidity.

Time of onset of Cadaveric Changes in India.

This is very variable. Sometimes it commences within a few minutes after death, under the conditions above noted, but usually in temperate climates it begins 5 to 10 hours after, and takes about 2 to 3 hours to develop.³ In India, owing to the climate and to the body becoming 'cold' more quickly, it usually commences 1 to 2 hours after death, and takes 1 to 2 hours to develop.

¹ Based on Dr. Mackenzie's data for July to September, 1889.

² *Ind. Med. Gaz.*, 1882, p. 167.

³ Niderkorn found it to be fully developed before the end of the seventh

hemorrhage, rigor mortis may continue for 14 days or longer (*Ind. Med. J.*, 71). The figures apply to a cold climate.

Onset of Rigor Mortis.—Of the 36 cases observed by Mackenzie in Calcutta, in July to September, the earliest onset of *rigor mortis* was 30 minutes, the latest 7 hours, and the average 1 hour and 56 mins. In 6 cases it was from 30 minutes to 1 hour, in 19 cases from 1 to 2 hours, in 5 cases from 2 to 3 hours, in 2 cases from 3 to 4 hours, in 3 cases from 5 to 7 hours.

In cases where just previous to death the muscles have undergone great fatigue, and also in cases where the irritability of the muscles has been exhausted by a powerful electric discharge, as in death from lightning stroke, also in death from cholera, tetanus, poisoning by opium or strychnia, rigidity may come on at once and the body stiffen in the position it was in at the time of death. On the other hand, in cases of sudden death, except from lightning, rigidity comes on late, provided always, of course, that the muscles just previous to death have not been subject to great fatigue, or to anything tending to exhaust their irritability.

Duration.—This depends greatly on the state of the muscles at the time of death. Generally speaking the sooner rigidity sets in the *sooner* it passes off, and the longer it is in appearing the *longer* will it last. It averages 24 to 48 hours in temperate climates (Tidy), but may continue for several days. Cold tends to prolong and heat (probably) to shorten it. For India, Dr Mackenzie¹ observed the following times. Of 36 cases the shortest duration was 3 hours, the longest 40 hours, while the average was 19 hours and 12 minutes. In 3 cases it lasted less than 5 hours, in 6 cases from 5 to 10 hours, in 3 cases from 10 to 15 hours, in 6 cases from 15 to 20 hours, in 14 cases from 20 to 30 hours, and in 4 cases from 30 to 40 hours.

Order of onset and disappearance.—In Europe this rigidity
 sets in first in the face and trunk, and
 in Bengal in the
 face, jaw and neck
 4th, lower limbs,

Case.—Time of death determined by *rigor mortis*.—Case of Jessie McIlhenny (Glasgow, 1862). *Reg. v. McLachlan*.—The body was first seen by Dr. Mackel on the night of the 17th July 1862.

and disappeared from all the joints except the knees and the ankles.

Death had resulted from violence and from profuse hæmorrhage. The victim was free from disease. *Rigor mortis* sets in generally from 10 hours to 3 days after death. When, however, death has been sudden, and

as nearly as could be, that this was the time which had passed between death and the examination of the body"—Taylor, 3rd Ed., I p. 85.

See also Gardner's case, and Sudhabode Bhattacharyj's case.

Cadaveric spasm, or instantaneous *rigor mortis*, is a term applied by Taylor and others to rigidity which in rare cases occurs at the moment of death in sudden deaths. This rigidity passes sooner or later into *rigor mortis* though not unnecessarily identical with it. It is usually muscular contraction. Very rarely important evidence as to the cause of death may be derived from the presence of objects in the hands under the influence of cadaveric spasm, but the object is not usually grasped, as the fingers usually relax after death.

Case—Alleged fabrication of evidence of suicide.—"A man tried in France, in 1835, narrowly escaped conviction as the murderer of his father. The latter had been found dead in a sitting posture, with a receipt in his hand, the weapon resting upon the slightest motion of the part would . . . It was assumed that the son had . . . which had been the cause of death, . . . in his father's hand, in order

The medical evidence, by showing could not have been simulated after on, *M. J. Lect.*, 365
de Bhattacharyj.

With the disappearance of rigidity, the 3rd stage of relaxation, due to incipient decomposition, commences; this softening is not necessarily putrefactive, as micro-organisms are not always found in the relaxed muscles in this stage.

7. Putrefaction, General.—This condition, which begins when *rigor mortis* ceases, is the most absolute and certain of all signs of death. It is the decomposition of the nitrogenous elements of the tissues by bacteria (chiefly *bacterium termo*) with colour changes and the evolution of foul-smelling gases. The changes occur generally in this order.

(a) **Colour changes.**—Externally a greenish spot appears on the abdomen with odour of putrefaction and the eyeballs become soft and yielding. Greenish discoloration spreads over body. It is due to destructive decomposition of the red blood corpuscles with the solution of their hæmoglobin in the serum. In Calcutta during the rains, Mackenzie found that the latest period at which the green discoloration

(b) *Blisters form under the epidermis.*—Mackenzie's latest period for the appearance of vesications on the surface of the body was 72 hours, the earliest period was 35 hours, and the average period was 49 hours and 39 minutes. In 17 cases it occurred in from 35 hours to 48 hours, in 10 cases from 48 to 60 hours, in 5 cases from 60 to 72 hours, and in 4 cases it was not observed at all.

(c) *Maggots appear.*—The time of appearance of these is much earlier in India than in Europe. The latest period at which *immature* maggots (which are chiefly the larvæ of the house-fly and flies of the "blue-bottle," *Calliphora* sp.) appear was in Mackenzie's cases 41 hours and 30 minutes, the earliest period was 3 hours and 20 minutes, and the average period was 25 hours and 57 minutes.

The latest period of the appearance of the *mature* or moving maggots was in Mackenzie's cases 76 hours, the earliest period was 24 hours and 18 minutes, and the average period was 39 hours and 43 minutes. In 6 cases it occurred in from 24 hours and 18 minutes to 30 hours, in 16 cases from 30 to 48 hours, in 11 cases from 48 to 72 hours, in 1 case upwards of 72 hours, and in two cases it was not observed.

(d) *Post-mortem emphysema.*—Gases distend cavities and tissues till
 e brain runs
 cause various
 ter contents.
 increasingly
 difficult. (2) "Causes the eyeballs and tongue to protrude." (3) "Puffs up the tissues of the neck which become greatly swollen, accentuating the natural groove which becomes pale and exsanguine from the mutual

open the body cavities. (5) Forces the contents of the stomach and lungs to escape from the mouth, often in the form of frothy and bloodstained mucus. (6) The pressure, before the abdominal wall gives way, drives the blood from the abdominal vessels into the vena cava, thence into the right side of the heart and into the lungs. Hence, other things being equal, the weight of the lungs gradually increases after death. In a large series of autopsies Pc
 Indian lungs to be. Left, 12
 in performed within four l
 when the autopsy has been

post-mortem delivery of the fetus up to the sixth month, and in cases where the os has already dilated and the female has died in labour, even a full term child may be delivered by the gaseous pressure. The uterus in the latter case is usually turned completely inside out. In the earlier

stages of pregnancy the complete uterus containing the foetus may prolapse.

From the above description it will be seen that gaseous decomposition

from ignorance of the natural processes of decomposition in hot climates.

(c) The softened flesh falls from the bones.—The brain, liver, spleen, stomach, and intestines putrefy most rapidly, the heart, lungs, kidneys, bladder, and blood vessels more slowly, the last organ in women to putrefy is the uterus.

Onset and rapidity of putrefaction.—This is so rapid in the hot plains of India that it visibly begins in about 25 hours; but no definite estimate can be given of its rate of progress. In Europe in summer it occurs within 1 to 3 days after death.¹ It is hastened or delayed respectively by the following conditions, affecting the growth of bacteria or animal organisms.

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putrefies more rapidly. Bodies putrefy more rapidly in air than in water, and less rapidly in earth than in water.

(c) **Moisture.**—Moisture promotes, and absence of moisture retards, putrefaction. Hence, putrefaction is more rapid in moist than in dry air and is much retarded by submersion in water, when the chemical change into adipocere may occur, see below. Bodies, however, after removal from water very rapidly decompose. 'Mummification,' see p. 91, may occur in hot dry air.

(d) Condition of the body, age and cause of death.—Putrefaction is more rapid in bodies of persons dying suddenly and in fat, flabby or dropsical bodies and in newly born children and in women dying in childbirth than in case of persons dying after a long illness. Bodies of persons who have been injured at the time of death putrefy more rapidly than those of persons who have not been injured.

and phosphorus, tends to delay putrefaction. Powell's experience is that in alcoholic poisoning decomposition is rapid.

(c) **Antiseptics and poisons.**—These, of course, retard putrefaction—arsenic, antimony and alcohol amongst poisons. Lime, contrary to the popular belief, retards putrefaction.

Adipocere.

Sometimes instead of the decomposition of putrefaction, the corpse may undergo the *post-mortem* change of (1) Saponification, forming *Adipocere*, or (2) Mummification.

Thus saponification change only occurs in the case of bodies wholly submerged in water or cesspools, or buried in deep moist graves. The substance then formed is chemically a soap of ammonia and lime, and is called 'adipocere' on account of its fat (*adeps*) and waxy (*cera*) appearance. It is probably produced by the fatty acids of the fat combining with the ammonia of the decomposed nitrogenous tissues of the body, and latterly as time goes on part of the ammonia is replaced by lime. Physically, it is a soft, waxy-looking substance, greasy to the touch, and varying in colour from a dull white to dark brown and of a disagreeable rancid odour. On fracture it exhibits traces of fibres and the blood vessels between which the soap is deposited. Its specific gravity is less than water, it melts at about 200° F., is soluble in ether and alcohol, and on heating with caustic potash it yields ammonia. It is a very permanent body and may last twenty years and upwards. The subcutaneous fat and bone-marrow first undergo this change; the normal internal organs are not often so altered.

Time required for the change.—Observers in Europe were of opinion that a low temperature by retarding decomposition favoured this change. Taylor and Casper show that adipocere has been found in bodies immersed in water from five weeks to one year, but rarely in less than three to four months, and all the soft parts had not completely undergone this change after a year's immersion. The process occurs more slowly in damp soil than in water, though in the case of a fetus buried in a damp cellar it occurred in three weeks (Casper). The bodies of children and obese persons are more rapidly converted on account of the excess of fat, and in the former case the fat contains three times more fatty acid with less oleic acid (Langer).

In India, however, Dr. Coull Mackenzie, police-surgeon of Calcutta, has recorded eight cases (*I. M. G.*, 1889, 42) in which this change seems to have occurred *within three to fifteen days after death*, thus apparently disproving the theory that a low temperature conduces to this change. These cases occurred in the submerged bodies of persons drowned in the Hughli river at Calcutta, or buried in the hot damp soil of Lower Bengal.

Cases.—(a) A male Hindu was killed in July by the kick of a horse, and was buried the following day. Four days after burial, the body was

exhumed in order that an inquest might be held. It was found in an advanced state of saponification externally, the heart and liver being also saponified. The body was buried in soft porous soil, saturated with moisture, the temperature being high, in the rainy season. (b) An adult Chinese woman alleged to have died in child-birth was buried in September under circumstances which necessitated an inquest. The body was exhumed seventy-six hours after interment, when it was found to be considerably saponified. Her body was buried in similar soil and temperature, and in a wooden coffin. (c) A young European was drowned in the river Hughli in September, his body being recovered seven days after. It was in an advanced state of saponification externally, the lungs, heart, liver, kidneys, stomach, and intestines were also saponified, and what is very curious is that the stomach contained undigested food (flesh and potatoes) of which the flesh was entirely saponified, the potatoes not being altered in the least. (d) A European sailor was drowned in the Hughli in October, and his body recovered eight days and ten hours after immersion, was found to have the external parts as well as the heart, liver, spleen, kidneys, stomach, intestines, and bladder

this change four days after death.

For a recent thoroughly ascertained case of rapid adipocere reported by Professor Powell of Bombay and supported by chemical analysis, see Appendix VI.

Mummification, or desiccation or shrivelling up of the body, by its losing rapidly its fluids.—This occurs only in hot dry climates with hot air in motion, such as in sandy deserts, *e.g.* Sindh, Beluchistan, etc., and parts of Upper India where the bodies are perched in trees or between the rafters of a roof.

Practical Examination of the Dead Body.

The clothes of the body should be examined before removed for the detection of signs of a struggle, marks of blood, etc., to enable comparisons to be made with injuries on the body. If the clothes are removed before being seen by the examiner, *post-mortem* rigidity will be destroyed in parts, abrasions or bruises may be found, and even the contents of the disturbed stomach may be forced into the mouth or larynx so as to give suspicion of accidental choking. First, the general condition of these should be noted, *e.g.* whether showing marks of fire, or corrosion; or wet, or stained with blood, dirt, secretions, or excretions. The clothes, etc., should then be more particularly

¹ Dr. Mour, *Ind. Med. Gaz.*, 1897, p. 197, and Dr. V. Aclie, *id.*

examined, note should be taken of any cuts or tears upon them, and of the correspondence or otherwise, of these with wounds on the body. Any peculiarities of the clothes, or of the ornaments found on the body, likely to aid in establishing its identity, should also be recorded.

External Examination of the Body itself.

For this the clothes should be taken off, and any marks resembling bruises washed to make certain that it is not dirt or external stains. In India, dead bodies are often submitted for examination in an advanced state of decomposition. Such bodies should nevertheless be examined exteroally, and as far as possible internally also; the fullest possible examination of the body should invariably be made, not necessarily for report to magistrate, but for inclusion in your own notes for reference, and to establish your own opinion. The plan of making a partial examination is only admissible when the body is extremely putrid and decomposed; but even in such cases, although the medical officer is at liberty to decline to make an internal examination of highly putrid corpses, some distinct evidence as to how death was caused may often be obtained, as for example, when this has been the result of wounds, fractures, or other violence, or of the administration of certain poisons; besides the condition of the uterus might give vital information, and the presence of solid faeces in the gut would negative alleged death from cholera.

External examination of the body should include a search for—

1. Signs indicating the Time elapsed since death.—That is, whether the body is warm or cold, its condition as regards rigidity, and the extent to which putrefaction has advanced. It is possible that an estimate formed as to the period which has elapsed since death may bear greatly on the question of (a) the identity of the body, and (b) the guilt or innocence of accused persons (see case below).

The question of how long a body has been dead is sometimes of the utmost importance in cases of murder where accused pleads an *alibi*.

The advanced state of putrefaction of a body may show, for example, that death must have occurred at a period considerably anterior to the date of disappearance of the individual whose body it is alleged to be, or as in the following case of Gardner the condition of the body of a murdered individual may show that death must have taken place at a time when

the accused had access to the victim, and not subsequently to the time of termination of such access.

Case.—Time of murder indicated by condition of body.—Gardner, the sweep.—Gardner lived with his wife and another woman, their servant. The wife was found dead in her bedroom, with wounds on her throat, at 8 a.m. Her extremities (which were uncovered) were cold, and rigidity was well marked. The circumstances of the case conclusively indicated murder, and Gardner was suspected and brought to trial. Gardner was proved to have left the house on the morning of the

dead more than four hours. Hence she must have died before Gardner left the house. This and the other evidence in the case led to the conviction of the prisoner.—Taylor, *Med. Jur.*, I. 83.

See also case of Sudhabode Bhattachary.

Any estimate, however, based on *post-mortem* examination must necessarily be only approximate. You should consider especially the following points:—

(a) *Temperature of the body.*—In the tropics where the temperature of surrounding objects is but little above that of the body the latter 'cools' in a few hours. Observations in temperate climates show that the dead body cools down to a temperature a little above that of the external air in fifteen to twenty hours, the fall of temperature being more rapid in the earlier than in the later hours after death.

(b) *Conditions of the muscles.*—If these are relaxed and contractile it is probable that not more than 1½ to 1¾ hours in the plains or 3 to 6 hours in the hills have elapsed since death. If rigid, probably more than 3 and less than 36 hours have elapsed in hills; for plains see table, p. 85.

(c) *Amount of putrefaction.*—Other things being equal, the greater the amount of this the longer the period which has elapsed since death. The rapidity of putrefaction, however, varies so greatly with the circumstances already detailed that no general rule can be laid down for estimating by its amount the length of time which has elapsed since death occurred.

2. *Marks of violence, or other external marks indicative of the cause of death.*—Note if there are any stains of blood, or other matters, on the surface of the body. In the case of blood stains, it is specially important to note their situation and form, as this may show that they have been produced by some individual other than deceased, e.g. the impress of a right hand on the right hand or forearm of the body. Specially search for bloody thumb- or finger-prints (see p. 56). Note whether or not *cutis anserina*¹ is present, and whether any matters are sticking under the nails. Note whether the features are pale

¹ Goose-skin, see 'Drowning.'

and natural, or livid and swollen, the condition of the eyes, and position of the tongue, and whether or not this shows marks of injury from the teeth. Examine the orifices of the body for presence of foreign bodies, marks of concealed punctures, and marks of corrosion, and note the nature of any fluid oozing from them. Examine, at first without dissection, the whole body for wounds or contusions, not omitting to examine by palpation the bones for fractures and to search for marks of concealed punctures under the breasts, scrotum, and eyelids, and in the armpits and nape of the neck, and, in the cases of infants, in the fontanelles, and along the whole course of the spine.

Then, employing such dissection as may be requisite, note in regard to all **wounds or other marks of injury** : (1) **Exact situation**.—This should be recorded with reference to some fixed point on the body, *e.g.* distance of a wound in inches from the top of the pubis or sternum, angle of the jaw, etc.; position, with reference to hyoid bone or laryngeal cartilages of a ligature mark on the neck, etc. (2) **Exact dimensions**, *e.g.* measured in inches, the length, breadth, and depth of wounds, breadth of ligature marks, etc. (3) **Direction**, *e.g.* in a punctured wound, whether it is directed from above down or below up, and whether from right to left or left to right; and in incised or other linear wounds or marks of injury, whether or not one end is higher than the other, and, if so, whether the upper end is anterior or posterior to, or to the right or left of, the lower. In the case of certain fractures, *e.g.* of the ribs, note whether the broken ends of the bone have been driven inwards or outwards, by the violence used to cause the fracture. (4) **Appearance**, and how far this indicates (a) the method, and (b) the time, of their production. Under (a) note, in the case of wounds, whether the edges are contused or lacerated, or apparently clean cut, and in the latter case examine them with the aid of a lens for signs of tearing, or appearance of inversion, indicative of production by a blunt weapon. Note the general shape of any wound, contusion, or burn; this may indicate the shape of the weapon or heated object which has been used. In the case of an *incised* wound, compare the appearance of the two ends of the wound, with the view of ascertaining the direction in which it was produced. In the case of a wound produced by a pointed object, compare the appearance of the two ends, and determine which is the entrance and which is the exit. Note also whether or no any blackening or marks of gunpowder exist round the wound. Examine any wound for the presence of foreign bodies, preserving such as may be found. Under (b) note, in the case of

wounds, whether or no the edges are retracted or averted, and whether or no blood or blood clots are present in the wound, or signs of inflammation exist around it. In the case of apparent contusions, note if the skin over them is abraded; examine the edge of the contused surface for changes of colour, and, by dissection, ascertain if the underlying tissues contain extravasated blood so as to distinguish ecchymosis from cadaveric lividity. In the case of ligature marks also, the condition of the tissues underlying the mark should be ascertained. If the injury is a burn note the presence or absence of vesication about it, or of a line of redness, or signs of inflammation around it.

Bear in mind, while conducting the examination, the characters which distinguish *ante-mortem* from *post-mortem* wounds and lacerations (*q. v.*). Recollect, also, that under certain circumstances putrefactive changes may simulate signs of strangulation. There may, for example, be protrusion of the tongue, due to such changes, and putrefactive swelling against a string loosely tied round the neck, may result in the production of a depressed mark, somewhat similar to that left by the ligature in death from strangulation.

In infants the external examination should, in addition, include examination for (1) degree of maturity, namely, length and weight, condition of the eyes, condition of the skin, nails, and scalp hair, and position of the middle point of the body and (2) live birth, or the reverse, *e.g.* exfoliation of the scarf skin, condition of the umbilical cord, presence of signs of intra-uterine maceration (see 'Infantide').

III. Internal Dissection of the Body.

After the external examination has been fully made, the internal examination by dissection should be performed as thoroughly and as soon as possible.

Preliminaries.—The warrant or authorization to perform a dissection should always be taken to the examination, and no one should be present at the examination out of mere curiosity unless authorized, and it is desirable that the examination should be made in daylight without artificial light, though in hot climates one cannot wait for daylight. Complete notes should be made during the dissection, and all measurements accurately determined. Injured parts, diseased organs or portions of them, if necessary, and all foreign bodies should be removed and preserved for further examination. All necessary

instruments, bottles, rubber gloves, antiseptics, etc., should be provided before commencing the dissection.¹

Examination should be complete.—Even if the condition of the parts first examined appears sufficiently to account for death, the remainder of the body should nevertheless be examined, so that you may be in a position to say, not only what was, but also, as far as possible, what was *not*, the cause of death.

Cases are on record, in which a complete *post-mortem* examination of a body has disclosed indications of a cause of death other than that indicated by the conditions of the parts first examined. The appearances first noted may, for example, indicate that death was due to mechanical violence, or to drowning, and yet, on further examination, indications may be found of death from poison (*q.v.*). Or again, the appearances first noted may indicate death from hanging, and yet further examination may show that death was due to strangulation (*q.v.*), or to mechanical violence (*q.v.*), and that the appearance indicative of death from hanging have been fabricated in order to make the case seem one of suicide. Again, if the *post-mortem* appearances show clearly that death was due to a particular lesion, your examination is not complete unless you have noted all particulars which may assist in arriving at an opinion as to whether the fatal lesion was the result of disease or of violence, and if the latter, whether the violence was accidental, suicidal, or homicidal. It has happened that in cases where the medical reports have shown that death was caused (1) by injury to the head, and (2) in case of a woman by strangulation, it was subsequently found that in the first case the ribs were crushed, and in the second, rape had been committed.

Order of making the examination.—If on the surface of the body marks of violence exist of such a nature as to indicate injury to the organs contained in any particular cavity, that cavity **should be first dissected**, and the exact effect of the violence ascertained. Incisions made through the skin for this purpose should avoid wounds likely to have penetrated the cavities underlying them, so that there may be no interference with the subsequent tracing of the exact course of the wound. In other cases, where a particular cause of death is *suspected*, that cavity should be first dissected in which appearances indicative of the cause of death are most likely to be found, *e.g.* in cases where it is suspected that death has been due to asphyxia, the thorax, and in cases of poisoning the abdomen, should be the cavity first dissected.

¹ In laque autopsies the operator risks fatal inoculation.

In cases where the cause of death is doubtful, the three chief cavities of the body should be dissected in the following order: (1) head, (2) thorax, and (3) abdomen; the spinal cord should be examined in suspected poisoning by strychnia, or some other of the alkaloids, in tetanus, and where there have been symptoms of spinal irritation or inflammation.

In all cases, before opening and dissecting the thorax, the cavity of the abdomen is to be opened, and (without further dissection) the position of the diaphragm, and general appearance of the contents of the abdomen ascertained. Should this preliminary inspection indicate that the cause of death is connected with the abdominal viscera, dissection of the abdomen should be proceeded with; if not, it should be reserved until after the thorax has been dissected.

The details and method of making the Necropsy are given in Appendix III. Remember that the more important viscera for examination after the brain are those of the thorax (the heart and lungs), then those of the abdomen, preserving in cases of suspected poisoning the contents of the stomach and intestines, and also large portions of the liver, spleen, and kidneys as detailed under 'Poisons.' In infants the examination should be directed not only to ascertaining (1) the cause of death, but also (2) the degree of maturity, and (3) whether or not it survived its birth (see 'Inheritance,' question 6, and 'Infanticide').

Opinion on cause of Death.

No opinion should be given as to the cause of death that is not fully warranted by the appearances observed. If in any case where, on *post-mortem* examination, you may fail to discover appearances sufficient to account for death, a negative opinion only should be given. You are not justified in reporting the death as due to 'natural causes' or 'heart failure'¹ simply because you have failed to find *post-mortem* appearances indicative of death from a non-natural cause. Again, you may find that death was due to a lesion, such as an effusion of blood into the substance of the brain, which may either have been the result of violence or of disease, and the *post-mortem* appearances may do no more than indicate that the fatal lesion was more probably the result of one than of the other. In such a case your opinion should be a one, and

¹ This phrase is too frequently a cloak for inquest if the heart had not "failed." If you find degeneration of the heart muscles, say so. If violence or cause of death, say so.

would

say

accompanied by the reasons which lead you to consider it to be more probable that death was due to disease or to violence, as the case may be.

The results of the examination should always be duly recorded at the time and on the spot, in a note-book kept for the purpose.

Death Certificates without Post-mortem Examination.

In respect to death certificates the State has entrusted the medical profession with very grave responsibilities, and it behoves every member of the profession to discharge these responsibilities honestly and honourably. The issue of every death-certificate should be regarded by the certifying medical man as a very serious responsibility, and it is especially so whenever there is the slightest suspicion that the death may be unnatural. Those deaths that are obviously "violent and unnatural deaths or sudden deaths of which the cause is unknown," must immediately be notified to the coroner, or the magistrate who in India performs the duties of coroner, and become the subject of his inquiry or inquest, in the course of which a *post-mortem* examination is usually made before a death-certificate is granted. All other deaths that occur are not so notified, but amongst them is always a considerable proportion with an element of legal doubt, in which a certificate cannot honestly be given without an autopsy. How are these cases to be dealt with?

If the doctor has strong, and, as he believes, well-founded suspicion that the death is unnatural, he should report to the coroner or police-surgeon at once without hesitation.¹

If there is only a slight suspicion (and it is desirable in the public interest that medical men, although not criminal detectives, should cultivate a certain amount of wholesome suspicion or detective acumen in regard to deaths) he may do one or other of several things. He (1) may get permission for an autopsy and do it, on which he may be able to certify or may have to report to the coroner, (2) he may be refused the autopsy on which he may refuse to certify, or may still certify conditionally, which is a weak move, or (3) he may report his suspicions to the coroner or magistrate without asking for an autopsy.

¹ Cf. F. J. Smith in *Trans. Med. Leg. Soc.*, 1912, pp. 56 et seq. from whom

For example, a frequently recurring difficulty in regard to a death-certificate is when a patient who has been treated for chronic disease (*e.g.* Bright's, heart trouble, bronchitis, phthisis, etc.) dies suddenly a considerable time after the doctor has ceased to visit him, and the former is asked to sign the certificate.

The question arises, at what length of time after his last visit in such a case is a doctor justified in giving a certificate and when is it justifiable? One way out of the difficulty is for the conscientious medical attendant to *refuse a certificate* of the ordinary character, but offer to write a letter to the registrar entering fully into the circumstances of the case, and if he accepts this your responsibility is halved. The 'circumstances' which will vary in detail must contain the following: (1) date and duration of your attendance upon the deceased and your views of his illness at that time; (2) the circumstances under which and the reasons why (*a*) you ceased attending then, and (*b*) you have not recently been in attendance; (3) the circumstances known to you about his home-surroundings—poverty, wealth, attitude of relations, and anything you may have heard from neighbours; (4) any efforts you may have made to obtain an autopsy, and the mode and manner in which these suggestions have been refused, and details you may care to impart to him respecting the close of his life, which from your own professional knowledge and experience may have led you to regard his death as natural or unnatural. Whatever action the registrar may take on this letter, it remains evidence of reasonable care on your part.

The only other solutions are two, namely, (1) swallow all scruples and fill up a certificate, taking care that your dates are scrupulously exact, put in the wholly objectionable words "as I am informed" (but see below) and let the registrar take what steps he likes; and (2) refuse point blank to certify or write, and then all responsibility rests between the registrar and coroner. The circumstances which compel you to one or other of these extreme procedures depend on the individual conscience and the local colouring of the case.

If you decide to give a certificate without a *post mortem* you should observe the following points:—

- (1) Re-read carefully immediately before writing the certificate the printed instruction thereof.
- (2) Remember if you refuse a certificate without reasonable excuse you are liable to a fine—'reasonable excuse' here can only mean (*a*) Cases of uncertainty as above discussed, (*b*) illness or accident on your own part sufficiently severe to render you incapable of writing or signing your name; (*c*) Bodily absence on your

part necessitated by professional urgency. It *must* be on the non-payment of the bill for attendance or any question of personal feeling between yourself and the deceased or the messenger who comes for it.

- (8) Never under any circumstances *ever* give a duplicate certificate for a medical death-certificate is an original document accepted without question by registrars and undertakers, and a surplus one may and has been used for felonious purposes to perjure or hush up a crime.
- (4) Only the man who was actually in attendance may sign the certificate, no one is authorized to sign on his behalf.
- (5) Never sign a certificate in blank to be filled in by even a qualified person. It is grossly dishonest, illegal, dangerous, and deserves heavy punishment when found out.
- (6) Write legibly.
- (7) Use the names of diseases in the "Nomenclature of Diseases."
- (8) "As I am informed," does not occur in the Act. The use of these words by an *honest* medical man in a death-certificate is inconceivable, as they are in direct antithesis to the very idea of a death-certificate, which means certain fixed positive knowledge, and hearsay is not recognized as such in law.
- (9) The distinction between 'primary' and 'secondary' is a mere technical difficulty which can cause little more than temporary embarrassment, when it is remembered that 'primary' here simply refers to time, and the certifier can use his discretion as to how far back he should go.

On the other hand, when there is the slightest suspicion that the death has been unnatural, and this includes not merely deaths by obvious and suspected personal violence, foul play, poison, criminal abortion, etc., but also by operative interference, anaesthetics, and all sudden deaths of which the cause is unknown, it is clearly the duty of the medical man to report to the coroner or to the magistrate who in India takes his place; or to try all fair means of persuasion to get permission for an autopsy, and failing this to report to the coroner or magistrate. Any private or unauthorized dissection of the body which may have the effect of biding a criminal offence or culpable negligence renders the operator liable to be made an accessory to the fact should any question of foul play or malpraxis subsequently arise.¹

¹ Dr. Wynn Westcott, *loc. cit.*, p. 66.

Exhumation.

This unpleasant task becomes necessary occasionally where a suspicion of poisoning or other foul play arises some time after the death; or it may be for purposes of identification, as in the case of the body alleged to be that of Livingstone, where identification on disinterment was made by the arm showing a badly united fracture, such as the deceased was known to have had.

son who claimed the Portland title and estate that the reputed death and burial of T. C. Druce, in 1864, at the age of 71, was a mock one, and that

In India, the practice of swift cremation of mortal remains upon the very day of death, which is prevalent amongst the more orthodox Hindus, who form the majority of the population, necessarily restricts the frequency of exhumations in this

ance of the deceased person who can identify the corpse; and if buried in a coffin be present. The ferably the early n be ready, and should be sprinkled around but not upon the body itself. If the coffin is broken, and in cases where there is no coffin, some of the earth above and below the body should be taken and preserved in cases of suspected poisoning for analysis.

The body should be exposed a short time

to allow effluvia to escape, and the observer should stand on the windward side. The stage of putrefaction should be noted.

In recent interments the usual *post-mortem* examination should be made as far as possible. In the external inspection a sample of any characteristic hair on the face should be preserved for identification. After examining the bodily cavities, the stomach and its contents, also contents of bowels, also the liver, spleen, and kidneys should be preserved and sealed in clean bottles for chemical analysis as detailed in appendix. All injured parts should also be removed and preserved when practicable. When a long interval has elapsed since burial, injuries to the bones, especially the skull, and in women to the uterus (which longest resists putrefaction) should be looked for, and where mineral poison is suspected a long bone, *e.g.* the femur, should be preserved for analysis.

Limit of time for exhumation.—There is practically no limit of time in English law to the utility of an exhumation. For so long as the bones remain these may afford valuable evidence by which the innocence of suspected persons may be proved, or, on the other hand, the exhumation may prove murder by arsenic or other mineral poison. The Druce case, above noted, shows that the identity in an ordinary vault in a temperate climate may remain clear for upwards of half a century.

CHAPTER IV.

ASSAULTS, WOUNDS, INJURIES, AND DEATHS BY VIOLENCE.

'ASSAULTS' and *wounds* or '*hurt*' form the greater portion of the cases coming under the medical officer's notice, and sometimes give rise to questions of much complexity; although medical evidence is especially required in cases where the injuries result in death.

Every attack upon the person of another is an '*assault*,' whether it injures or not; and no provocation by word spoken

stone at a person, but missing, constitutes '*assault*,' whilst throwing and hitting is assault and battery.

The legal conception of a '*wound*' is much more extensive than the surgical, which latter restricts the term to an injury accompanied by a breach of the skin, and excludes contusions, simple fractures of bones, and ruptures of internal organs. To obviate the use of this ambiguous term, and in view of the necessity for defining whether any particular injury is or is not a '*wound*,' is not defined by the Law; but the statute employs the terms '*hurt*' and '*grievous hurt*.' Simple '*hurt*' is thus defined:—"*Whoever causes bodily pain, disease, or infirmity, to any person is said to cause hurt*" (*I. P. C., s. 319*).

Grievous hurt.—The medical officer is often required to decide whether an injury is '*hurt*' or '*grievous hurt*.'

The following kinds of '*hurt*' are designated as '*grievous hurt*' (*I. P. C., s. 320*).

(1) Emasculation; (2) permanent privation of the sight of either eye; (3) permanent privation of the hearing of either ear; (4) Privation of any member or joint; (5) destruction or permanent impairing of the powers of any member or joint; (6) permanent disfiguration of the head or face; (7) fracture or dislocation of bone or tooth. (8) Any hurt which endangers life or which causes the sufferer to be during the space of

twenty days in severe bodily pain or unable to follow his ordinary pursuits.

Sometimes the healing of a simple wound of the scalp, etc., is deliberately delayed or prevented for twenty days so as to bring the severer penalty under this clause.

When an act done by another has caused 'grievous hurt,' or 'hurt,' the doer of the act may be charged with the offence of voluntarily causing 'grievous hurt,' or 'hurt,' as the case may be, or according to the circumstances of the case, with the graver offence of 'attempting to commit murder' (s. 307), or 'culpable homicide' (s. 308), and causing hurt in such attempt.

The kind of weapon used affects the gravity of the offence. Thus, by ss. 324 and 326 (*I. P. C.*), the causing of hurt or grievous hurt by certain specified means is made an offence more severely punishable than when such means have not been used. Amongst the means thus specified are "any instrument for shooting, stabbing, or cutting, or any instrument which, used as a weapon of offence, is likely to cause death."

Deadly injury.—If an act done by another results in death, the doer of the act may be charged with the offence of committing 'culpable homicide,' or of "causing death by a rash or negligent act."

Culpable homicide (a Scottish term, the English equivalent is manslaughter) is defined in s. 299 of the *I. P. C.*,¹ and the

¹ Section 299 of the *I. P. C.* is as follows:—"Whoever causes death by doing an act with the intention of causing death, or with the knowledge that he is likely by such act to cause death, commits the offence of culpable homicide

been prevented."

accused may be convicted of this offence even if death followed as an indirect result of the injury (see s. 299, Explanations 1 and 2).¹ Culpable homicide, according to the circumstances of the case, may or may not amount to murder. Again, when a person has committed suicide, any one who has abetted him in doing so is punishable under ss. 305 or 306 of the Code. By s. 305 abetment of suicide may be punished with death, if the suicide was under eighteen, or was insane, delirious, or intoxicated at the time. Attempts to commit murder, or culpable homicide, are punishable under respectively ss. 307 and 308 of the Code, and attempts to commit suicide under s. 309.

Death or hurt caused by a Rash or negligent act.—Where a person has caused the death of another by an act not amounting to culpable homicide, he may be charged with the minor offence of "causing death by a rash or negligent act" (s. 304A). Similarly where a person causes hurt or grievous hurt to another, under circumstances which do not amount to '*voluntarily causing hurt*' (I. P. C., 321, 322), he may be charged with the minor offences of '*causing hurt*' (s. 337), or '*grievous hurt*' (s. 338), by doing an act "so rashly or negligently as to endanger human life or the personal safety of others." In cases such as these, besides the main question, namely, has the injury caused, or is it likely² to cause '*death*,' '*grievous hurt*,' or '*hurt*'? a subsidiary question may also arise, namely, is the character of the injury such as to indicate intention, or absence of intention, to cause a particular result?

Examination of 'Hurt' and Wound cases.

The police bring to the medical officer with the individual to be examined a printed form with the undernoted headings

¹ The word "likely" amounts to "inferred" in the injury, as first of these two descriptions; but only to the homicide not amounting to murder) if it falls w

(culpable

Wounds caused in this way are generally, but not invariably, vertical to the bone.

(2) **Edges.**—These should be examined with a lens. Sharp, clean cut, uninverted edges, indicate the use of a sharp-edged weapon; tearing and inversion indicate the employment of a blunt weapon, or production without a weapon.

(3) **Length and depth.**—Long incised wounds indicate the use of a sharp-edged weapon, and may either be caused by a single blow from one with a long, tolerably straight edge, such as a sword, or by a drawing cut from one with a short edge, such as a razor. In the former case, the method of production is often indicated by the underlying bones being clean cut through; and in the latter by the wound tailing off at one end into a superficial scratch (see also (1) kind of weapons, (2) direction of the wound).

The Weapons in Incised wounds.—The axe or hatchet class usually produce comparatively short incised wounds; either deep, or accompanied by indentation and extensive fractures of the bones beneath. Cutting instruments with a concave edge and projecting point often cause linear wounds resembling a punctured wound at one end gradually decreasing in depth towards the other end. Or if the wound has been inflicted on a curved surface, the puncture caused by the point, and the incised wounds caused by the edge, may be separated by an unwounded portion of the skin.

glass, etc

2. **Contused and lacerated wounds.**—These are often the result of injury by means other than the employment of a weapon. Thus they may result from (1) Injuries by broken glass—broken-glass wounds, however, if slight, are apt to resemble incised wounds; (2) Falls on some projecting, more or less sharp object; (3) Injuries from wild animals; or

(4) Machinery and railway accidents. Severe contused and lacerated wounds are often accompanied by very little hæmorrhage due to (a) shock or (b) bursting or crushing of vessels.

Slight non-accidental lacerated wounds, produced without a weapon, may be the result of injuries inflicted in forcibly tearing out ornaments, or by the teeth or nails. If a wound of this class has been produced by a weapon, and much contusion or laceration is present, the indication, of course, is that a rounded or blunt-edged weapon has been used. Sharp-edged knives, it should be noted, if used with considerable force, cause bruising and laceration of the parts divided.¹

Gunshot wounds resemble contused and lacerated wounds in character, and indicate, of course, the employment of a firearm, but not necessarily the discharge therefrom of a hard projectile. If the wound is single, it may have been caused by a firearm loaded with powder and wadding only, if the weapon has been discharged near the body. Nearness of the weapon to the body at the time of discharge is indicated by *blackening of the skin from the gunpowder*, except with cordite and modern gunpowder, or by scorching, charring, or blackening of the clothes at the seat of injury. A single wound, however, may be caused by a firearm loaded with a hard projectile, which in such a case will usually be found lodged in the wound, though a bullet may be so deflected by a bone, etc., as to pass round and out again by the entrance wound. Two orifices caused by the same discharge, indicate the employment of a hard projectile. When two orifices are present, the orifice of entry will usually be found to be smaller and more depressed than that of exit, which latter is usually ragged and everted. More than two orifices may be caused by one projectile, *e.g.* when this has entered the body after traversing a limb, or has split up against a sharp ridge of bone into two pieces, each finding a separate exit; or more than one orifice of exit may be caused by an intact bullet and a splinter of bone punched off by it. A wound in the neck, produced by a thrust with a "pointed perfectly circular bamboo," was mistaken for a gunshot wound.

In the case of a shot-gun wound, if the distance from which the gun is fired is within 12 inches, the wound will, as a rule, be single, while beyond this each shot will make a separate wound,² but it will depend also on the charge, size of shot, bore of weapon, and whether 'choke' or cylinder. A single pellet of shot may cause death by penetrating the aorta, or the brain through the eye. Fatal wounds may be caused by

¹ Ogston's *Lects on Med. Jur.*, p. 420

² Casper, I. 266.

gunpowder and wadding alone if fired within about 4 inches from the body.

Contusions or bruises.—Under this term are included all degrees of injury produced by blows, kicks, or sudden pressure from explosions where the skin is not divided, ranging from a simple *bruise* on the surface of the body to one accompanied by fracture of underlying bones and rupture of internal organs.

In almost all contusions there is more or less extravasation of blood into the tissues constituting ecchymosis. The amount of blood effused is not entirely determined by the severity of the blow, but to some extent by the looseness of the particular tissues at the site of the blow, and by the condition of the blood of the individual, or the extensive effusion from a blow on the eye, and the bruises produced by a comparatively gentle grasp on flabby women with thin skins.

Ecchymosis shows itself as a dark, dull-reddish-blue discoloration of the skin, which in about twenty-four hours begins to change colour, becoming lighter, and changing in tint to violet, then to green, and lastly to yellow, and finally disappears altogether in about five or six days. These changes in colour commence at the circumference of the patch, are due to varying degrees of solubility of the pigments into which the hæmoglobin breaks up, and to dilution of the effused blood by the serum of the cellular tissue and subsequent absorption, and occur only during life.

After a few minutes after
a fading it passes
zones of brown,

grows, and gradually, and so on.

Deep ecchymosis.—This may not appear on the surface for several days after the injury, and not always directly over the site of injury. Where there is yet no discoloration of skin, the effused blood may be detected by palpation.

Ecchymosis (a) may occur at a distance from the spot to which violence has been applied, e.g. at the seat of fracture of a bone broken by indirect violence; (b) may occur in spots (petechiæ), and as large extravasations indistinguishable from bruises, but without violence in some diseases, e.g. scurvy, and some cases of snake poisoning; (c) other things being equal, is in amount less, the better the bodily condition of the individual injured and greater the looser the texture of the skin at the

to the body.

violence has
wall, as by a
in the absence

of ecchymosis, the fact of the existence of an internal injury caused by

external violence is, during life, a matter of surgical diagnosis. After death, the existence of an internal solution of continuity may be ascertained by dissection, and, in the absence of ecchymosis, its connection with external violence is sometimes indicated by bruising of the parts lying between it and the surface. If such bruising is absent, as well as ecchymosis, the question whether or no the solution of continuity discovered has been caused by external violence, may be a difficult one to decide, requiring consideration of points such as (a) the freedom, or otherwise, from disease of the affected part, (b) the situation of the affected part, and its degree of liability to rupture from causes other than external violence, ¹ and (c) the history of the case.

Cadaveric lividity, discoloration of the skin due to *post-mortem* staining may, to a certain extent, simulate ecchymosis, especially when this, owing to the pressure of a sheet or other covering on the body, occurs in stripes resembling marks of flogging. It however differs from ecchymosis in being dependent on the stagnation of the blood, and in its true nature being a discoloration of the skin, not a rupture of the vessels. It is easily distinguished from ecchymosis by the fact that it disappears on pressure, and is not accompanied by swelling or a papular eruption.

The weapon in contusions.—If a weapon has been used, it will probably have been a blunt or rounded one, such as a stick or club. Frequently the shape, etc., of the weapon or instrument employed can be inferred from the shape and situation of the patch or patches of ecchymosis. Weapons commonly employed in India in the production of severe injuries of this class are: (1) a **bamboo staff** or club, often bound with iron (*lāthi* or *sonta*), or when bound with iron (*lehabandi*). Harvey ² mentions that about 32 per cent. of the medico-legal cases reported in Bengal, etc., during the three years ending 1872 were *lathi* wounds; and (2) the **rice-pounder**, a club usually of hard wood about 3½ feet long, and 1½ to 2 inches in diameter, shod at one end with a thin iron plate about 1½ to 1 inch long. This latter is a common weapon of assault in the Madras Presidency. Instruments more or less frequently used in India in producing slight injuries of this class, requiring special mention are, (1) **shoes**—beating with a shoe is supposed to add insult to the injury; and (2) **ropes** or cords, used either for the purpose of tying up the sufferer as a mode of torture, or to secure the victim during the infliction of other injuries. Usually the arms are secured behind the back by binding together the elbows or wrists. The **split-cane** (*bet*) used in Assam and Burma, for tying bundles, often makes a clean-cut wound. In the mangling form of torture by **bamboo-crushing** (*bansdola*), in which a bamboo on which men are

¹ See injuries to the brain, thorax, abdomen, etc., pp 119 et seq.

² *Bengal Med. Leg. Rep.*, 1870-72, p. 20.

sitting is rolled backwards and forwards over the chest, there may be no external mark of violence or bruising yet the ribs may be broken and the lungs lacerated, as recorded by Chevers.

3. Punctured wounds.—Punctured wounds may be caused accidentally by projecting nails, fragments of crockery, etc. If the edges of the puncture are free from laceration or contusion, the indication is that a sharp-pointed weapon has been employed. Sometimes, but not always, the shape of the weapon which has been used is indicated by the shape of the puncture in the skin. Dupuytren found, however, that cylindrical pins produce elongated openings¹. The obliquity or directness of the thrust, and also the state of tension or relaxation of the skin, may affect the shape of the puncture, and hence two punctures from the same weapon may differ in shape. Very often also, owing to the elasticity of the skin, a punctured wound is of less diameter than the weapon which has been used. Sometimes in a punctured wound, the broken-off point of the weapon employed is found. Punctured wounds are occasionally found in concealed situations, *e.g.* in the rectum or vagina, in the armpit, or under the upper eyelid. A minute puncture in certain situations, *e.g.* over the fontanelles in infants, or in the nape of the neck, may indicate a mortal wound. The existence of several punctured wounds of course very strongly indicates the employment of a weapon, and if all are similar in size and shape the probabilities are in favour of their being due to repeated thrusts with the same weapon.

The weapons in punctured wounds used in India, besides knives and weapons of the bill-hook class already mentioned, are (1) daggers (*kalaris*), of various shapes—in some of these the handle is transverse to the axis of the blade; (2) the spear (*bhalam*, *barchi* or *sulfi*); (3) arrows (*tir*); (4) sickle (*hasua*). Arrow wounds, it may be pointed out, are frequently fatal.

In Bengal, etc., in the three years ending 1872, there were fifteen fatal cases out of a total of twenty-five. The case below illustrates the great penetrative power frequently imparted to these projectiles. The pickaxe (*gainti*), hoe-fork (*kanta-kudali*) may also cause a punctured wound, probably with much contusion, and punctured wounds may be produced by thrusts with a pointed bamboo.

Case.—Arrow wound.—A Hindu female, aged fifty. An arrow, having first passed had penetrated sticking in the b passed through

¹ *Bengal Med. Leg. Rep.*, 1870-72, p. 416.

the right lobe of the liver, pierced through the lower lobe of the right lung, and penetrated about an inch into the spine behind the heart and root of the lung. There was a large quantity of fluid and clotted blood to the right of the spine, but the heart was uninjured.—*Ind. Med. Gaz.*, 1875, p. 257, Dr. S. Manook.

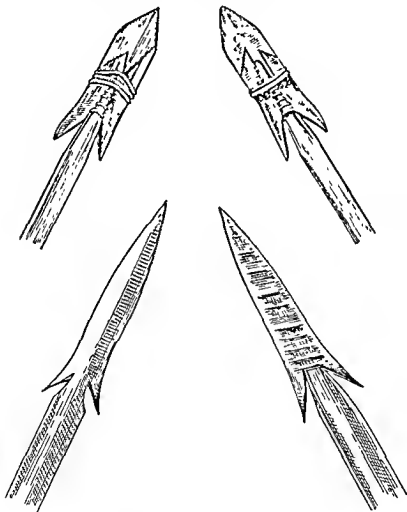


FIG. 11.—Poisoned Arrows of Aka Tribe
(Half actual size. From a drawing by L. A. Wadell.)

Same weapon may cause wounds of different classes.—A heavy weapon of the bill-hook class may, for example, produce all four varieties. Hence the existence on the body of the same individual of wounds belonging to two or more of these

four classes, does not necessarily indicate that two or more weapons were employed, or that more than one person was concerned in their infliction.

Injuries by animals may produce wounds of any of the above classes. —Injuries without visible solution of continuity, often severe enough to cause death, are sometimes caused by elephants kicking, trampling on, or butting the injured individual, or by the animal seizing the individual with his trunk and dashing him forcibly on the ground. Apparently incised wounds may be caused by the tusks of the wild boar. Harvey describes such wounds as "long, clean rips," and mentions a case in which a wound so produced, on the inside of the left thigh, was twelve inches long, three deep, and one broad, and, dividing the femoral arteries, caused death by hæmorrhage. Fatal, contused and lacerated wounds may be caused by various animals; thus they may result from a bite, or from a blow with the paw, or from injury by the claws, of an animal of the tiger class, in which case the neck is often the seat of injury; or they may be the result of a bite from a crocodile, or of an injury inflicted by a bear, in which last case the scalp is often found greatly torn. Again, contused and lacerated wounds may be the result of injuries inflicted by domestic animals, e.g. a kick or bite from a horse or cow. Punctured and lacerated wounds may be caused by the tusks, or more frequently by the horns, of animals. In Bengal, etc., in three years, twenty cases of gores by horned cattle, ten of them fatal, were reported. On the whole, injuries caused by animals are so characteristic in appearance that there is seldom any difficulty in deciding as to their origin.

Case —Kicked to death yet no external marks. —A woman was kicked to death by her husband. Her body was found by neighbours and a doctor called who reported no marks of violence, and death probably due to natural causes. A *post mortem* was made and the sternum found fractured in both places, and two days later a second *post mortem* was made when extensive discoloration of the back noticed and thought at first to

crime would not have been suspected —F Crookshank, *Trans Med Leg Soc*, 1909, 19

4. **Internal injuries without visible wound.** These may be accompanied by serious internal solutions of continuity, e.g. fractures of bones, or rupture of some internal organ (see p 119, etc.) such as the spleen, and hence may be of any degree of severity, from extremely slight to mortal wounds.

Case —In 1884, when the insane Rajah of Kolapur died suddenly after a struggle and fell from his keeper, it was found that several ribs were broken without any external marks

Examination of Wound Cases.

The following points should be noted in all Wound Cases in the living as well as in the dead¹

¹ *Medico-Legal* F Smith's *Med. Jur.*, p 160

1. Kind (wrenched, lacerated, etc.)	With reference to kind of weapon (and degree of offence), danger to life.
2. Number ..	With reference to self-infliction, struggle, kind of weapon, hemorrhage, etc.
3. Position on body	With reference to self-infliction.
4. Direction and organ wounded	With reference to danger to life, how inflicted.
5. Size (length and breadth)	With reference to how inflicted, danger to life
6. Depth	With reference to danger to life
7. Edges and ends	With reference to kind of weapon
8. Foreign bodies present	With reference to how inflicted.
9. Hemorrhage amount	With reference to danger to life.
10. Inflammatory reactions	With reference to time inflicted, ante, or post, mortem.
11. Cuts and stains on garments	With reference to kind of weapon, how inflicted, etc.

In wounds in the dead, in addition to the above, carefully examine and note down the appearance of the wound without disturbing the latter, and photograph it if possible. Note amount of blood effused and the presence of spirted blood-stains on objects in the neighbourhood where the injury was received. Whether the blood is coagulated, and firmly so; presence of *rigor mortis* and *post mortem* stains. Then the interior of the wound may be examined as to clots; and in stab cases the direction and depth explored gently by a blunt bougie, the deeper course of the wound is to be exposed by dissection without interfering with the external wounds which should be preserved for comparison with the alleged weapon. If a bone is injured, the injured portion should be removed as evidence.

Artificial Bruises in Malingering and for False Evidence.

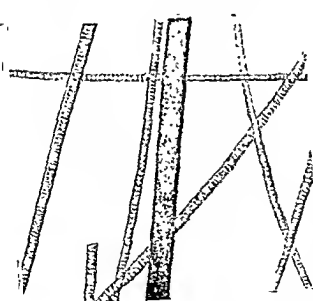
The appearance of bruises and blisters is sometimes produced by malingerers or for false evidence in India by the application of the common weed Lal Chitra (*Plumbago rosca* or *Zeylanioa*)

Case.—Artificial "Bruises" by Lal Chitra.—In 1912 two undertrial prisoners, accused of murder, while confined in the Jhenidah Sub-jail, brought a charge of torture against two constables and a Sub-Inspector of Salkura p.-s., one of them complained of having been branded with a

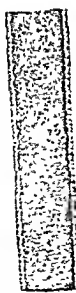
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a — HUMAN HAIR $\times 130$



b — CAT'S HAIR $\times 130$



c — GUINEA-PIG'S HAIR

(from Micro-Photographs by Dr. H. Gribbes.)

(To face p

1. Kind (incised, lacerated, etc.)	With reference to kind of weapon (and degree of offence), danger to life.
2. Number	With reference to self-infliction, struggle, kind of weapon, hæmorrhage, etc.
3. Position on body	With reference to self-infliction.
4. Direction and organ wounded	With reference to danger to life, how inflicted.
5. Size (length and breadth)	With reference to how inflicted, danger to life.
6. Depth	With reference to danger to life.
7. Edges and ends	With reference to kind of weapon.
8. Foreign bodies present	With reference to how inflicted.
9. Hæmorrhage amount	With reference to danger to life.
10. Inflammatory reactions	With reference to time inflicted, <i>ante</i> , or <i>post</i> , <i>mortem</i> .
11. Cuts and stains on garments	With reference to kind of weapon, how inflicted, etc.

In wounds in the dead, in addition to the above, carefully examine and note down the appearance of the wound without disturbing the latter, and photograph it if possible. Note amount of blood effused and the presence of spurted blood-stains on objects in the neighbourhood where the injury was received. Whether the blood is coagulated, and firmly so; presence of *rigor mortis* and *post mortem* stains. Then the interior of the wound may be examined as to clots; and in stab cases the direction and depth explored gently by a blunt bougie, the deeper course of the wound is to be exposed by dissection without interfering with the external wounds which should be preserved for comparison with the alleged weapon. If a bone is injured, the injured portion should be removed as evidence.

Artificial Bruises in Malingering and for False Evidence.

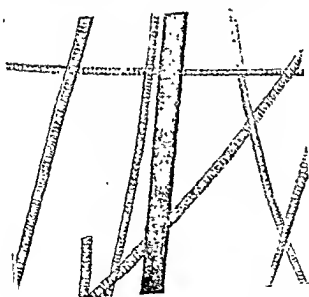
The appearance of bruises and blisters is sometimes produced by malingerers or for false evidence in India by the application of the common weed Lal Chitra (*Plumbago rosca* or *Zeylanica*).

Case.—Artificial "Bruises" by Lal Chitra.—In 1912 two undertrial prisoners, accused of murder, while confined in the Jhenidah Sub-jail, Sub-Inspector [redacted] and with a [redacted] assaulted In [redacted]

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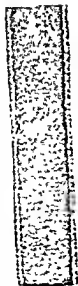


a.—HUMAN HAIR $\times 130$



b CAT'S HAIR $\times 130$

(From Micro-Photographs by Dr. H. G. Alden.)



c.—GUINEA-PIG'S HAIR \times

(To face p. 11)



on the body of the prisoners were in Mr. Quarry's opinion caused by the use of certain plants common in the locality—probably with the connivance of the jail warders. In support of this supposition he cited the following instances. In 1911 when he was at Bhagalpur two prisoners, some three
a charge of
showed some
of opinion that

beating with a stick some ten days before the examination. The Superintendent of Police in the presence of Mr. Quarry marked the arm of a head-constable with a seed (Latin name *Samcarpus Anacardium*, Bengali name Bhela) commonly used by *Dhobis* for marking clothes. The following morning the Collector, the Superintendent of Police, and the two doctors mentioned above met and the head-constable was examined. Both the doctors expressed a decided opinion that the marks on the head-constable were bruises caused by beating some ten days before the examination.

Mr. Quarry while at Jhenadah heard of a plant which, if touched, would leave a mark like a bruise. He sent for a stem of this plant, and it was brought to him within half an hour, which shows that it is a common plant and is not difficult to find. With the stem he just touched the forearm of a constable and within an hour there was a nasty looking

Evidence from Foreign Bodies.

Foreign bodies found in the wound: such as broken pieces of glass, splinters of bamboo or other wood may indicate the means by which a wound was caused, also the broken-off point of a knife or dagger, or the projectile or wadding or pellets of gunpowder of a firearm. Deep punctured and gunshot wounds should specially be searched for foreign bodies of this latter description, and, if found, should be preserved for production in court, as they are frequently of great importance as links in a chain of evidence. For example, the broken-off point of a knife found in a wound, may exactly fit a knife alleged to have been used, or this may have a perfect point, showing that it was not the weapon employed. Again, a projectile found in a gunshot wound may fit, or be too large to have been discharged from, the firearm alleged to have been used, or a piece of paper or cloth, used as wadding, and found in a gunshot wound, may correspond to similar fragments found in possession of the accused. Foreign bodies are not always found in gunshot wounds; a projectile, for example, may have completely traversed the body or may have lodged and subsequently dropped out, as sometimes happens when the wound is shallow,

¹ *Bengal Criminal Intellig. Gaz.*, Feb. 11, 1916.

or when a portion of clothing has been carried into the wound with the projectile.

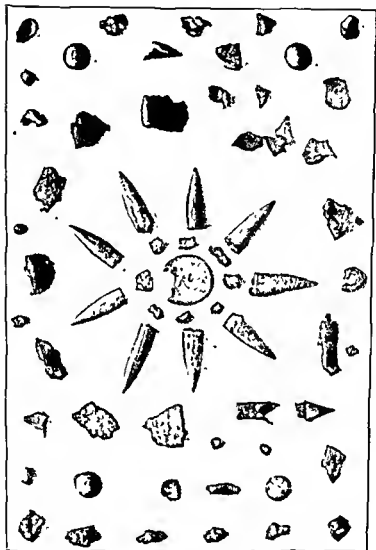
For detecting foreign bodies in wounds and for the existence and particulars of fractures the Roentgen rays may be used. X-rays photographs are admissible as evidence in medico-legal cases, but the 'skiagram radiograph,' being only a *shadow* picture, is liable to distort the truth unless it is carefully made and its details are interpreted by skilled persons

Evidence from Alleged Weapon.

The alleged weapon may affect the question of the guilt or innocence of the accused. Thus the character of the injury may show that it could not have been caused by the weapon produced by the prosecution. The alleged weapon should be compared with the wounds themselves, and with any cuts on the clothes. It should also be examined for stains of blood, adhering fragments of hair, etc. If a firearm, it may show signs of recent discharge. Recently discharged firearms will be found blackened inside the barrel, from the residue left by the gunpowder after ignition. This residue consists mainly of finely divided carbon and potassium sulphide, and yields to water a dark-coloured liquid, alkaline in reaction, and which, after filtration, strikes a black colour with a solution of a lead salt. After a time the potassium sulphide becomes oxidized into potassium sulphate, rust (hydrated ferric oxide) also forming. Hence, owing to the oxidation of the sulphide into a sulphate, some time discharged, blackening with lead powders, cordite, etc., is different. Again, the weapon alleged to have been used may show signs of recent fracture, or be bent or otherwise injured as the result of its use.

Was Injury inflicted during Life or after Death?

Injuries inflicted after death, although often the result of accident, may also be the result of design, the motive being



BULLETS AND FOREIGN BODIES FROM WOUNDS

(After Major A. Mackworth T.M.N.)

[To face p. 117



either concealment of a crime, or fabrication of evidence in support of a false charge. Further, the fact that an injury severe enough to cause death was inflicted during life, is evidence in favour of its having been the cause of death. Hence the importance of this question.

Case.—**Fabricating wounds and mutilating bodies of the dead.**—Decapitation is done by the rest of a gang to prevent identification in cases of wounded or killed thieves as related by Chevers, or the mutilation may be done with a dead body to fabricate a false charge of murder against a particular party. Thus in the *Nizamut Adalat Report* for Bengal, Vol. VI. 1856, p. 834, and 1855, p. 180, a case is reported from Tirhut. The body of a deaf and dumb beggar who had died of disease was found fearfully hacked and cut, leaning against the house of a person against whom the accused had a grudge. Four persons were convicted by the judge, but were acquitted by the higher court. For some other instances of mutilation, see Chevers, *Med. Jur.*, 479 to 500.

Ante mortem injuries are distinguished from *post mortem* injuries by the presence of signs indicative of vital action. These may conveniently be considered under the heads of (1) Ecchymosis; (2) Effusion of blood, (3) Other signs

1. **Ecchymosis.**—Contusions inflicted during life, if severe, are generally, but not invariably, followed by ecchymosis. Ecchymosis may appear even if the individual has lived only a very short time after receipt of the injury, and further, ecchymosis from blows inflicted during life may not appear until after death has taken place. The presence of ecchymosis, however, does not necessarily indicate that the injury producing it was inflicted during life. Christison found that blows inflicted on dead bodies, within two or three hours after death, were followed by ecchymosis, not distinguishable from ecchymosis the result of blows inflicted during life. If the individual has lived for some time, say more than twenty-four hours after receiving the injury, changes in colour will probably be found at the circumference of the ecchymosed patch, from purple to black, violet-green to yellow—thus affording a clue to length of time inflicted. Thus the purplish-black becomes by the third day violet, by the fifth day green, and by eighth to tenth day yellow, and the injured part will probably be found swollen. The presence at the circumference of the ecchymosed patch of changes in colour of the above kind and the presence of swelling of the injured part, show that the injury was inflicted some time before death.

2. **Effusion of blood.**—In a dead body the blood remains fluid for some time after death, rarely beginning to coagulate

until four hours, and sometimes not until twelve hours, after death. Hence an injury inflicted after death, while the blood is still fluid, may be followed by effusion of blood. Owing, however, to arrest of the heart's action, no arterial spouting occurs, and the quantity of blood effused is much less than would be effused from a similar injury inflicted during life. Further, blood effused from a wound, made more than ten minutes after death, rarely coagulates. Hence, marks of arterial spouting indicate infliction while the heart is beating. Much hæmorrhage also indicates *ante mortem* infliction, and if the blood effused is found coagulated, the presumption is strong that the injury was inflicted either during life, or very shortly after death. *Post mortem* infliction is indicated if the effused blood is found fluid, but not necessarily by the quantity of effused blood being small, seeing that severe contused and lacerated wounds, inflicted during life, are sometimes followed by but little hæmorrhage.

3. **Retraction and eversion** of the edges of wound follow the infliction of an incised wound made during life or shortly after death. Wounds other than incised wounds, inflicted during life, exhibit this character in proportion to the closeness with which they approximate in nature to incised wounds. Hence in incised wounds, or wounds approaching in character to incised wounds, indications of infliction during life, or shortly after death, are:—(a) retraction and eversion of the edges of the wound; (b) hæmorrhage into the wound, and into the cellular tissue around it; and (c) the presence of coagula. In throat wounds, Dr. A. Powell has remarked inversion of the edges in the wounds due to the retraction of the platysma muscle in the cut skin.

SUMMARY OF *ANTE* OR *POST MORTEM* INFLECTION

Signs of inflammation around injury	Indicate infliction	Certainly before, and probably 24 hours before, death
Discoloration at circumference		
Marks of arterial spouting		Before death
Extensive hæmorrhage		
Coagula		During life, or very shortly after death
Retraction and eversion of the edges of the wound		During life, or probably not more than three hours after death
Ecchymosis		
Complete absence of all the above characters		Probably more than twelve hours after death

Special Wounds according to Regions: Head Wounds.

Scalp.—Contused and lacerated, and even apparently incised wounds penetrating to the skull are especially likely to follow blows from blunt weapons on the scalp. Occasionally from such blows, the inner surface of the scalp is found ruptured without there being any rupture of the outer surface. Wounds of the scalp only are not likely to cause danger to life, except from the supervention of inflammation and erysipelas. Other things being equal, these are more likely to follow contused and lacerated, than clean-cut wounds. Erysipelatous inflammation, although a common sequel of scalp wounds in temperate climates, appears rarely to follow such wounds in India. On the other hand, the scalp may seem uninjured, yet the brain may be injured by fracture of the skull or concussion or hæmorrhage.

Skull.—Separation of the sutures without fracture may occur, even in old persons, from mechanical violence. Harvey records sixteen cases—one an old man of seventy—in which this was the result of *lathi* blows. Fractures of the skull may be simple or compound, direct or indirect. Simple fracture is a usual result of a fall on a flat surface, while fractures from blows with blunt weapons are, unless the head is protected by a thick turban or some similar covering, usually compound. Fractures from blows with blunt weapons are in the great majority of cases direct, *i.e.* at the site of the blow. Indirect fracture, *i.e.* fracture by counterstroke, common as a result of falls, is comparatively rare as a result of blows with weapons. In fractures of the skull the danger to life mainly depends on the amount of injury to the brain; and other things being equal, the amount of such injury is likely to be greater, the thinner the bones at the seat of fracture. Hence blows on the temple and punctured wounds of the orbit are specially likely to be attended with danger to life.

injury to the brain substance. In the vertical wounds the inner table is frequently fractured, although there may at first be an absence of head symptoms. One of the worst instances of extensive sword-cuts of the skull is the Jhelum case, here cited.

Case.—Multiple sword-cuts through skull and other bones.—A tragedy is reported by Lt.-Col L. A. Waddell from Jhelum in May, 1881, where he saw a *sais* (groom) caught red handed in the act of killing his wife and her paramour with an Afghan sword, inflicting remarkably extensive cuts through bones, in which the latter were sliced through almost as if they were cheese. The wife endeavouring to save her paramour received a cut which bisected the left side of her chest from the spine to the sternum as if the thorax were sawn through in half, and vertebrae, across left lung severed both bones of the right claspings her paramour, and the

hand was left hanging only by . . .
instantaneous in a pool of blood
sais dealt him a cut at his head.

ran to the other
to complete the

SPINE. THE SPINE WAS one-edged and exhibited after the tragedy a somewhat sinuous edge, through being wrenched out of the cut bone into which it had become embedded. The *sais* was a muscular, middle-aged man, who had no experience in wielding a sword. He made no attempt to deny the crime, but pleaded provocation. He suffered the death penalty.

Brain.—Injury to the brain frequently follows a fracture, especially a depressed fracture, of the skull, and, as stated above, is the main source of danger in such fractures. Injury to the brain may, however, occur without fracture of the skull, and sometimes results from a comparatively slight blow on the head. As in the case of fracture of the skull by counterstroke, the seat of the injury to the brain may be at a point opposite to the spot to which the violence was applied. The brain injury may be a *contusion followed by concussion*. An injury of this kind may prove immediately fatal, or produce temporary insensibility, which may closely resemble intoxication, and be only distinguishable from it by the absence of alcoholic odour in the breath; or may produce only slight immediate effects, but be followed after an interval by inflammation, ending in death. Guy, for example, mentions the case of a woman who

received an injury on the head, and after remaining well for twelve days, fell ill and died with symptoms of compression; and also the case of a girl who, after a fall on the head, suffered simply from headache for six weeks, but died two months after the fall from brain affection. The injury may be *compression*, caused by depressed bone, effused blood, or the products of inflammation. The brain is specially likely to be injured by depressed bone, in punctured fractures, and in fractures in situations where the bones are thin

Effusion of blood on the surface, or into the substance of the brain, may occur with or without fracture of the skull, and may cause immediate insensibility, followed by death in a few minutes, or, when the effusion occurs slowly, insensibility may not set in for an hour or more. The middle meningeal artery is frequently ruptured, as a common occurrence, with or without fracture of the bone, as a result of a fall or blow. Often there is no immediate unconsciousness or only a momentary stunning, after which the patient may walk many miles and transact his business. Later, perhaps some hours later, effusion takes place between the *dura* and the skull, perhaps accelerated by some stimulant or excitement. Coma sets in as a result of compression, and the patient dies unless surgically treated. Coroners' juries frequently censure house surgeons who have failed to recognize such cases and to detain them in hospital. Professor Powell has held autopsies on three such cases in the practice of one house surgeon who had not correctly diagnosed any of them. Effusion of blood from violence *without fracture* of the skull, may or may not be accompanied by appearances of contusion of the integuments covering the skull. If accompanied by such appearances, the question may arise whether the effusion was the result of the external violence which gave rise to these appearances, or the result of disease or excitement. A similar question also may arise even in cases where no marks of external violence are apparent, as effusions of blood from violence may occur without any external signs of injury being present. An effusion of blood from violence is generally, unless the brain itself be torn, on the surface, and not in the substance, of the brain. It is commonly located immediately below the seat of violence, but in some cases is found at a point directly opposite thereto. Effusion of blood from *disease or excitement* is sometimes extremely difficult to distinguish from effusion caused by violence. From disease, however, effusion rarely occurs in persons under the age of forty; most commonly takes place in the substance of the brain, and careful examination will generally disclose a diseased

condition of the vessels. Effusion from excitement—alcoholic or non-alcoholic—may occur in persons of any age. Signs of congestion of the cerebral vessels co-existing with effusion, are to a certain extent in favour of disease or excitement being its cause. It must further be pointed out that even if the probabilities are in favour of an effusion being due to violence, the question may still arise whether the violence was a blow, or the result of a fall. Questions of this kind not infrequently arise in the case of a fight between intoxicated persons. Blows are interchanged, the individuals perhaps are separated; one of them is then seen to stagger and fall, becomes insensible, and dies. *Post mortem* examination shows the cause of death to be effusion of blood on the surface, or into the substance of the brain. In such a case it is often difficult in the extreme to arrive at a definite conclusion on the question as to whether the effusion of blood was the result of (a) a blow received during the fight, or (b) excitement or disease, or (c) the fall after the termination of the struggle. Compression from the products of inflammation may set in and prove fatal several days or weeks after receipt of the injury.

Lacerations of the brain may be caused by a weapon or projectile penetrating the skull, or by fragments of depressed bone; or may occur without injury to the skull, either immediately below, or at a point directly opposite to, the seat of the violence. Wounds of the brain are, of course, attended by great danger to life. Very severe wounds of the brain, accompanied even by loss of substance, may not cause immediate death, or even immediate insensibility, and in exceptional cases recovery may take place.

Face.—Wounds of the face are not likely to be dangerous to life unless the orbit is involved or the injury or resulting inflammation extends to the brain. Injuries to the face by causing permanent disfiguration, loss of sight, or teeth, etc., often come within the definition of 'grievous hurt'. Slitting or cutting off the nose is a recognized punishment for unfaithful wives, who after the operation are described as '*Nakti*' or 'nosed'. Often when the victim is a female the lips or breasts are also wounded, but no other injury may be present, indicating either submission of the sufferer to the punishment, or the participation of several persons in the outrage. When the victim is a male the motive is commonly either sexual, or punishment for theft; or, if the teeth have been employed, the injury may have been inflicted in the course of a struggle, and indicate no special motive. Injuries to the nose and ears

caused by forcibly pulling out ornaments are not uncommon, especially in females, and may, by causing permanent disfigurement, amount to grievous hurt. In such cases the motive may either be theft, or desire to cause hurt. Injuries to the eyes also are not uncommon, and may be the result of direct violence, *e.g.* gouging out by the fingers, or injury by a sharp-pointed weapon, the motive for infliction of the injury being similar to those leading to wounds of the nose or ears. Or the injury may be the result of indirect violence, and indicate no special motive. As examples of injury to the eyes from indirect violence, it may be mentioned that blows with a club on the head sometimes cause rupture of the eyeball; and wounds of the eyebrows are sometimes followed by amaurosis.

Cases—Gouging out the eyes.—In 1854, a very brutal case was tried at Mangalore, in which the paramour of a married woman, becoming
curved knife and
34.
both the eyes of
her, because she

given of a man
who, having tied the hands and feet of his wife, throw her down, sat upon her breast, and put out her eyes with a heated iron. In the case of bodies found exposed in the fields or jungle, it should be remembered that the eyes are generally the parts first attacked by birds of prey

The loss of a tooth from a blow is a common complaint, but it is usually false and intended to establish a charge of 'grievous hurt.' The knocking out of teeth is rather rare in India, as the fist is seldom used for assaults. When blows are delivered over the mouth or eyes it is usually with a shoe. In false cases there will likely be no signs of injury to lips or gums or adjacent teeth, although the alleged weapon is usually a thick *lathi*, or a large stone, the cavity is usually old and contracted, and the teeth of complainants, usually an old man or old woman, are generally loose. The incisor tooth produced in such false charges is usually unbroken, and old and dry.¹

Spine and Spinal Cord.

Generally the danger is in proportion to the extent of spine injured. Death occurs instantaneously if the medulla and upper part of the cord be wounded. Serious injuries to the

¹ W. D. Sutherland, *Ind. Med. Gaz.*, 1899, 241

cord above the third cervical vertebra are immediately fatal from paralysis of the muscles of respiration. Serious injuries lower down give rise to secondary effects, from which death may follow long after the receipt of the injury. Injury to the spinal cord may occur without fracture or dislocation of the vertebrae. A blow, for example, on the spine, may cause concussion of the cord followed by paralysis, or may set up inflammation followed by softening of the cord.

Concussion of the cord sometimes results from a railway accident, and in actions for damages in cases where this injury is alleged to have been received, the question whether the plaintiff's symptoms resulted from the accident or from disease, or are pure malingering, is sometimes a very difficult one to deal with.

Fracture of the second cervical vertebra with displacement and immediate death, is a not infrequent result of a fall from a height on the vertex. If the bones or ligaments are diseased, very slight violence may cause displacement and fatal injury to the cord, and Taylor mentions a case in which displacement of the odontoid process, and fatal injury to the cord, appear to have been caused simply by the muscular effort of throwing the head forcibly back. Fatal injury to the cord from non-accidental violence may be caused without a weapon. Fatal fracture of diseased vertebrae has resulted in several cases from the well-meaning but ignorant efforts of bonesetters. Fatal fracture—dislocation of the cervical vertebrae—has also resulted from reprehensible horseplay in lifting up children by the head "to show them London." In Urdu "to show them a deer" or "the children of the sun." Fatal injury to the cord, unaccompanied by injury to any portion of the body other than the spine, is rare as a result of blows from blunt weapons, but may occur when the neck is the seat of the injury, and may even occur without any external marks of violence being present. In one of Harvey's cases, for example, a woman aged sixty was killed by a blow with a club on the neck. Death resulted from injury to the cord due to displacement of the vertebrae, but no external marks of violence could be seen, although on dissection blood was found effused into the muscles of the nape.

Hacking the spine with a sword, bill-hook, or other heavy cutting weapon—causing sometimes decapitation—is a common mode of murder all over India, and specially so in the Central Provinces, Oudh, and the Panjab.

Neck Wounds.

Injuries of this region from mechanical violence other than the use of edged weapons, are chiefly dangerous to life from their effect on the spinal cord. A case cited by Harvey, however, shows that mechanical violence may cause very extensive, possibly fatal, injury to the soft parts in front of the neck without dividing the skin. Wounds of the neck from edged weapons are often suicidal, and often also homicidal. In cut throat, suicide is more or less contra-indicated, if the wounds are multiple, unless one only is severe, or if the wound is single and of great severity, more than sufficient to destroy life; or if the wound is low down on the neck. Wounds of the neck vary in danger to life according to their situation and depth. From the position of the large blood-vessels lateral wounds are more dangerous to life than wounds in front, and wounds low down on the neck more dangerous than wounds high up. Wounds of the windpipe only are attended with little danger to life. Wounds of the neck dividing the gullet are almost always fatal. Wounds of the large vessels are mortal injuries, death resulting either from hæmorrhage, or from entry of air into the circulation. Wounds of the carotids are not necessarily immediately fatal.

Case—Survival in cut throat.—Chevers quotes a case in which a man, with the carotid artery divided, survived until the following day. It appeared that a man was aroused in the night by two thieves, who were in the act of stealing in the house. In the struggle which ensued one of them cut him in the neck, and they escaped. After receiving the cut, he said that he had seen the prisoners, whom he named, stealing his *goor*, that he had seized one of them, and that the other cut him on the neck with a *dhaor*, or knife, and both made their escape. The accused not having come with the neighbours, were sent for and confronted with the wounded man, who accused them as above. The man's brother stated that the occurrence happened late at night, and that it was then moonlight. The man died the following day. The civil surgeon's evidence was as follows: "I found an irregular deep wound on the neck, apparently caused by the sharp, pointed instrument, the wound, in my opinion, was not caused by the man's own hand, the carotid artery was divided, and deceased had bled to death." It is to be regretted in this case that it is not recorded whether it was the *external* or the *common* carotid artery that was divided. If it was the latter, Chevers says that this is the only recorded case of so long a survival, but Taylor

(ed. of 1883, Vol. I., p. 631) says: "There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and even running a certain distance."

Case—Prof Powell reports: "Ten years ago when driving to the Morgue, I observed a scuffle going on about sixty yards in front of me. A constable came running in my direction holding a handkerchief to his neck. I called out to him to attend to his business instead of running away from it, and took his number to report him. About an hour later his dead body was brought to the Morgue. He had been stabbed in the neck, and had run a distance of 80 yards before he fell. I found the right common carotid severed in two thirds of its diameter."

Thorax Wounds.

Penetrating wounds of the chest perforating the heart or one of the large vessels, are mortal, but not necessarily immediately mortal, wounds. In such wounds the rapidity with which death occurs greatly depends on the rapidity with which hæmorrhage takes place.

Wounds of the heart may be penetrating or non-penetrating according as they injure the wall or penetrate the cavity. Ninety per cent are penetrating. The chief dangers of the former are shock and injury to the coronary artery. A needle puncture rarely causes hæmorrhage from the ventricle, but from the auricle it does. Pericarditis, endocarditis, and empyæma are secondary complications. Loss of blood may occur comparatively slowly if a large vessel is only punctured, and the puncture is small; or if the heart is wounded, if the wound is small, or oblique in direction. After a wound of the heart an individual may even survive several days. Taylor mentions two cases, one of survival for eleven days with a bullet one-third of an inch in diameter lodged in the septum between the ventricles; and another of survival for five weeks with a mass of wood lodged in the substance of the heart. Recovery may occur.

Taylor mentions that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others death took place from four to twenty-eight days.—See cases of recovery cited by Powell, *Ind. Med. Gaz.*, 1902.

Case—**Wound of heart**.—A case narrated by Mr. William White of Rangoon.—"A soldier was wounded in the storming of the Great Pagoda on 14th April, 1852. The ball entered a little above the anterior fold of the left axilla, taking an oblique direction to the cavity of the chest. At first he appeared to be doing well, and the wound closed. Subsequently his health declined, with feverish symptoms and evidence of pulmonary disease. A few days before his death it was noticed that

the action of the heart was weak but natural, its systole, or contraction, and diastole, or relaxation, regular and equal. He died worn out and emaciated on the 24th June. On examination, the bullet was found in the left ventricle of the heart, in its most interior part."—Chevers, *Med. Jur.*

Even when death occurs rapidly considerable power of locomotion may remain after receipt of a wound of the heart, as in the case already mentioned, where a man ran eighteen yards after a stab penetrating the right ventricle. Taylor also mentions a case in which it is probable that a man ran over eighteen feet after a gunshot wound "shattering to atoms" the auncles and part of the aorta. If the lungs are wounded, death may occur rapidly from hæmorrhage, or after a time from inflammation, but wounds of the lungs are not necessarily mortal. A wound completely transfixing the chest, other things being equal, is not more dangerous than a simple penetrating wound.

Non-penetrating wounds and injuries of the thorax are dangerous to life in proportion to the amount of internal injury. Serious internal injuries of this class are usually, but not invariably, accompanied by fractures of the ribs, but fractures of the ribs may be present without other internal injury. If a rib has been fractured by direct violence, *e.g.* a blow from a blunt weapon, it is usually found broken in one place only, and the ends are driven inwards. When the fracture has been the result of indirect violence, the broken ends are usually driven outwards, and the fracture, if single, is generally at the point of greatest convexity. Ribs when fractured by indirect violence are often broken in two places, one in front and the other behind. Very often also when the violence is of the nature of a force compressing the thorax, the fractures are symmetrical or nearly so, *i.e.* fracture of a rib on one side of the body is accompanied by fracture of the corresponding rib on the other side.

Compression of the thorax, causing symmetrical indirect fractures of the ribs, may be due to accidental violence, *e.g.* 'buffer-crushing' on railways, the fall of a heavy weight on the front of the chest, or more rarely to a fall from a height. More frequently it is the result of homicidal violence, and may be due to pressure with the knees, tramping underfoot, or to compression of the body between two barrels, a process known as '*bans-dola*'. Again, it may be due to kneading with the knees and elbows, or '*kid kani*' (see also injuries to the liver). Dr Harvey mentions a case in which symmetrical rib fractures

were present, but no external marks of injury were to be seen on the chest, and suggests that in the case in question the compressing force was probably pressure with the knees.

Non-penetrating injuries of the thorax may injure the lungs or heart in falls from a height, compression of chest by falls of heavy weights, wheels, buffers, or by blows. If the lungs are injured, hæmorrhage or inflammation, either of them ending fatally, may follow, even when there is no fracture of the ribs. Emphysema may be present, but this is only dangerous to life from mechanical impediment to respiration. The phrenic nerve was ruptured with instant death in nine cases reported by Dr. Coull Mackenzie (*Ind. Med. Gaz.*, 1889, p. 204).

Rupture of the heart is a comparatively rare result of non-penetrating chest injuries. Dr. Harvey mentions fourteen cases in the three years 1870-72, five of them homicidal, and in several the heart was healthy, but in most there was fracture of rib or sternum and external signs of violence. Dr. Coull Mackenzie describes five cases¹ of rupture of heart alone, one with rupture of spleen and one with rupture of other organs. The five former were caused by heavy weights falling and the other two by running over by laden carts. In four no external injury was visible, and in two no fractures of bones were present. Dr. Gibbons reports one case² caused by blow of a thin stick with death in three hours and without fracture of bones. Rupture of the heart may occur independently of external violence, or, if the heart is diseased, from a comparatively slight amount of violence. Again, external violence may cause rupture of an even healthy heart, and yet no external marks of injury be present. Hence, when the heart is found ruptured and no marks, or slight marks only, of external violence are present, it may be difficult to say what was the cause of the rupture. Non-penetrating chest injuries may cause rupture of a large thoracic blood-vessel, *e.g.* of the pulmonary artery, pulmonary veins, or superior vena cava. Rupture of the diaphragm also may occur (see below).

Abdomen Wounds.

Penetrating wounds unaccompanied by any internal injury are, even if accompanied by protrusion of viscera, not necessarily fatal. Death when occurring rapidly is usually from

¹ *Ind. Med. Gaz.*, 1889

² *Ind. Med. Gaz.*, 1897, p. 443

shock, or after an interval from peritonitis. Moreover, such wounds, and also wounds or rupture of the diaphragm, are liable to be followed by hernia, and may hence (from strangulation) cause death indirectly, after a long interval. With a penetrating wound of the abdomen, there may be a wound of a vascular organ or large vessel leading to death from hæmorrhage; or a hollow viscus may be wounded and extravasation of its contents be followed by fatal peritonitis.

Fatal non-penetrating injuries of the abdomen may leave no external marks of violence. In some, but not all such cases, the tissues immediately underlying the skin at the seat of injury may on dissection be found to show signs of bruising and to contain extravasated blood. Blood, however, it must be recollected, may in rare cases be found extravasated in the muscles of the abdominal wall, without violence having been applied. Taylor¹ mentions two such cases; in both the extravasation was inside the muscles around the navel. A non-penetrating injury unaccompanied by any wound of the contents of the abdominal cavity may cause immediate death from shock. This is specially liable to occur from a blow over the region of the solar plexus, and in such a case, after death, no marks of violence, external or internal, may be discoverable.

be discovered on the most careful examination. "I therefore reported that, as blows inflicted upon the front of the abdomen had been known, in several instances, to cause death by a shock to the nervous system, it was probable that in this case like force applied to the side of the belly had acted in a similar manner."

Or an injury of this class may cause death from peritonitis, in which case after death, no lesion other than signs of inflammation of the peritoneum may be found. More frequently the cause of death in fatal non-penetrating abdominal injuries is rupture of a viscus such as the spleen or liver. Rupture of a viscus, however, it must be recollected, may occur from *post mortem* violence, especially when decomposition is far advanced. An idea of the relative frequency of occurrence in India of rupture from violence of the different abdominal viscera may be gathered from the following figures. Among the fatal medico-legal cases reported in Bengal, etc., during the three years ending 1872, rupture of the spleen occurred in 564, liver in 129, bowels in 25, kidney in 24, urinary bladder in 8, and of the stomach in four or five cases.

Spleen.—Rupture of the spleen is of somewhat frequent occurrence in India,¹ especially in the more fever-saturated districts where the spleen is often much enlarged by disease,² and thus rendered liable to rupture from very slight violence. Indeed, the enlarged spleen sometimes undergoes **spontaneous rupture** with fatal results without the application of any external violence. The normal spleen of Indians as found by Prof. Powell in 2000 autopsies on Indians (omitting cases of malaria, plague, pneumonia and hæmorrhage) weighed a few grains under four ounces

Cases—(a) **Spontaneous rupture of enlarged spleen.**—Ali Bux, a fine-looking old Mohammedan, aged about 50 years, was engaged in a lawsuit in the Unballa court. In cross questioning one of the witnesses, suddenly fell down and expired. The friends, who brought the body to the Civil Hospital, were emphatic that he had not received any blow or knock of any kind, and an inspection of the court where he became faint, convinced me that there was no furniture or projecting angles where he could accidentally have knocked against something to cause internal injuries. Autopsy—On opening the abdomen on 11th October, I found the peritoneal cavity full of a blood-stained fluid. There were also fresh blood-clots.

there were as

9½ inches by

to and parallel with the hilus, was a rent in the capsule, 6 inches in length. The opening was plugged with fresh black blood clot. The substance of the spleen was soft and friable. There were no other injuries or signs of disease.—C. H. James, *Ind Med. Gaz.*, 1902, p. 222

(b) On 5th March, 1878, a beggar woman, Kanuni, 30 years of age, who had been suffering from enlargement of the spleen for several years, at 3.30 o'clock in the morning complained of severe pain in her abdomen in the region of the spleen. No remedies were applied or given to her internally, and very shortly after she expired. At the autopsy on the same forenoon. The body was much emaciated, the abdomen

¹ Lt.-Col. D. G. Crawford's analysis of 301 cases of ruptured spleen showed

was somewhat enlarged, but there were no external marks of violence on it. The abdominal walls were not bruised. The liver was large, fatty and anæmic. The kidneys were fatty and anæmic. The other organs except spleen were healthy. The spleen was 12 inches long, 7 inches broad, and weighed 3 lbs. 14 ozs. Its substance was very hard, and there were two ruptures, each an inch long on the inner surface

- (c) A native male of about 25, suffering from malarious fever and g of the 29th December, 1878, sensory of the Mayo Hospital by slowly, with the assistance of Hooghly for a distance of about

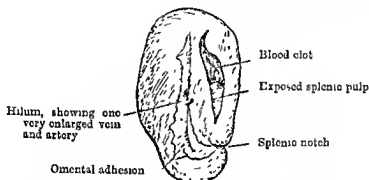


FIG. 12 —Showing Rent in the Spleen Capsule half-filled up with Blood-clot

half a mile to a landing-place, on reaching this spot he sat down, and shortly after had several convulsions, vomited a good deal, and died in about half an hour. I examined the body about 12 hours after death when I found it to be well nourished and to have no external marks of violence on it. The lungs were healthy, and there were extensive recent pleuritic adhesions of the outer surface of the left lung to the inner surface of the thorax. The spleen was about 12 inches long, 8 inches broad at its lower and 3 inches at its upper end. It was hard. There were two ruptures on its inner surface and through its hilum, each 2 inches long. All the other internal organs were healthy and were anæmic. There was a large quantity of dark fluid blood extravasated into the abdominal cavity. I gave it as my opinion that the deceased died from spontaneous rupture of spleen.—Mackenzie, *Ind. Med. Gaz.*, 1889, p. 322.—Two further cases are published in the *Ind. Med. Gaz.*, 1904.

This liability of the enlarged spleen to be so easily ruptured is taken into account judiciously in awarding punishment to cases where a blow, kick, etc., has caused death in this way. For so slight often is the force required to rupture a diseased spleen, that in many cases where this occurs from violence

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9½ inches by 6½, and was 3½ inches thick. On its inner surface, anterior to and parallel with the hilus, was a rent in the capsule, 6 inches in length. The opening was plugged with fresh black blood clot. The substance of the spleen was soft and friable. There were no other injuries or signs of disease.—C. H. James, *Ind Med Gaz*, 1902, p. 222.

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¹ Lt.-Col. D G Crawford's analysis of 304 cases of ruptured spleen showed that it occurred in 308 per cent of the fatal cases sent by the police for medico-legal examination.—*Ind Med Gaz*, 1902, p. 212

² McLeod quoted by Chevers, *Med Jur* (p. 462) points out that rupture

and two margins, anterior and posterior, the former often being notched. C... .. the normal size and weight of the adult (European) spleen as

enlargement is infection with either malaria or the 'Leishman Donovan parasite'

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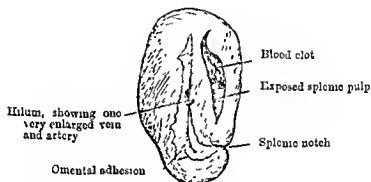


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inflicted by another, there is no intention of causing death. In a few cases (8 out of 262) the ruptured spleen was not enlarged.

Cause of Rupture.—The rupture may be caused by accidental violence, *e.g.* a fall, or from the sufferer having been run over by a wheeled vehicle. In non-accidental cases it is often the result of a blow or a kick or a push against a wall or other hard body, without a weapon.

In 102 of the 247 cases of Dr Crawford the cause was beating with a *lathi* or other heavy blunt instrument. Blows with fist, kicks or slaps or two or more of these combined accounted for 62, or over one-fifth. Falls from trees and in one case from a bridge gave 22 cases, 17 were run over by carts, and 23 were said to have been murdered.

A trivial blow may cause fatal rupture.

Case.—Rupture of spleen by slight blow.—Nabu Sheikh, Musalman male, 40, of Diwanganj, 14th November, 1886, said to have been killed by a *stah*. A small wound, $\frac{1}{2}$ inch long, gaping $\frac{1}{2}$ inch wide over eighth left rib, about five inches above and external to the umbilicus. From its outer end a slight scratch runs upwards and outwards for three inches. This wound was quite superficial, $\frac{1}{2}$ inch deep, penetrating only into and not through the subcutaneous cellular tissue. Peritoneum healthy, contained about half a pint of dark fluid blood round spleen. Stomach healthy, empty. Liver enlarged and congested. Spleen enlarged, about twice normal size; a rupture three inches long, crossing outer side half-way between upper and lower ends. Death was due to rupture of the spleen, probably caused by the blow, trifling in itself, which inflicted the wound over eighth rib.—Dr. D. G. Crawford, *Ind. Med. Gaz.*, 1902, p. 215.

Case.—Rupture of Spleen by Artificial Respiration.—Professor Powell reports an autopsy in a case where the spleen was ruptured by a medical man in performing artificial respiration for opium poisoning.

It may occur without any external marks of violence being present—this was so in about one-third of Harvey's cases—but in about one-fifth of these the tissues under the skin over the region of the spleen, on dissection, showed signs of bruising. Rupture, even of an apparently healthy spleen, may be unaccompanied by external marks of violence, but in such cases the subcutaneous tissues will probably (but not certainly) show signs of bruising.

Site of the rupture—this is generally on the inner surface.

Period of survival after rupture.—Death may occur in a few minutes or not for several days. Chevers mentions one case of survival for five days and another of death on the eighteenth day from pleurisy and pericarditis. Considerable power of locomotion may remain after receipt of the injury.

Dr. E. G. Russell, I.M.S., gives two¹ cases in which recovery apparently took place after rupture or bruise of the spleen; the diagnosis, in one case, being confirmed by dissection of the victim, who died several years afterwards. He also quotes four cases in which the victim survived the injury for over twenty-four hours; in one case five, in two four, and in one two and a half days. Dr. Powell relates a case of a European lady, aged 60, who was knocked down by a cart, drove to hospital in a springless cart and lived eight days. Her spleen was found ruptured at the *post mortem*.

Cases.—(a) Dacca, Hindu male, 31, said to have been beaten on 2nd

healthy; stomach healthy, contained a little muddy fluid; spleen slightly
 wver end of anterior border,

, said to have been beaten
 to the Campbell Hospital
 of August, *post mortem* on

7th August. There was an oblique longitudinal mark, five inches long, across the left side of the back, with fracture of four ribs, the eighth to eleventh left ribs. The left temporal and parietal bones, and the left wing of the sphenoid bone, were fractured, liver pale, waxy, bloodless, spleen much enlarged, weight 1 lb., a rupture, $\frac{1}{2}$ inch long, on inner aspect, left kidney weighed 6 ozs., a rupture in it, $\frac{1}{2}$ inch long. There can be no doubt about the facts of this case, as the boy was in hospital from the day of the injury till his death. He had undergone fracture of three of the bones of the skull, four ribs, and rupture of two viscera. Yet he survived for no less than seventeen days, and, in the end, the immediate cause of his death appears to have been inflammation of the meninges of the brain.—*J. M. G.*, 1902, p. 219

Wounds of the spleen are rarer than rupture.—In Dr. Crawford's series there was only one case to every fifty of rupture. Death has in several cases resulted through hæmorrhage from exploration of the spleen with a hypodermic needle in cases suspected to be malaria or Kala Azar.

(a) Dacca, 2nd January, 1872, Musahman male, age not noted, said to have been killed with a needle. Marks of puncture in left hypochondrium. Abdominal cavity contained a great quantity of fluid blood, and a clot weighing 1 lb 15 oz. Spleen weighed 3 lb 15 oz., and on its outer surface were punctures corresponding with those in abdominal wall, made by a sharp instrument. The examination was made by Dr. J. N. B. Wise, an authority on native customs who made the following remarks:—"Death due to hæmorrhage from puncture of spleen. It is

¹ Malaria, its causes and effects 1888 pp. 45 and

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enlarged, a small rupture $\frac{7}{8}$ inch long at lower end of anterior border, $\frac{3}{4}$ to $\frac{5}{8}$ in of blood effused around the rupture

c, fifteen, said to have been beaten admitted to the Campbell Hospital the 6th of August, *post mortem* on longitudinal mark, five inches long, fracture of four ribs, the eighth to eleventh left ribs. The left temporal and parietal bones, and the left wing of the sphenoid bone, were fractured, liver pale, waxy, bloodless, a rupture, $\frac{1}{2}$ inch long, on inner rupture in it, $\frac{1}{4}$ inch long. There his case, as the boy was in hospital with. He had undergone fracture of three of the bones of the skull, four ribs, and rupture of two viscera. Yet he survived for no less than seventeen days, and, in the end the immediate cause of his death appears to have been inflammation of the meninges of the brain — *J. M. G.*, 1902, p. 219

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¹ *Monist. de Chirurgie und Gef. 1880* pp. 215 and

customary for *kabiraj*s, under certain circumstances, to plunge iron needles into the spleen, when enlarged. This case was an unfortunate selection, as the organ was soft and vascular."

(b) Dacca, 14th November, 1880, Hindu female, 45, said to have died of wounds. A wound between scapula, six inches long, one broad, one deep. A second wound between tenth and eleventh ribs on left side, six inches long, 1½ broad, penetrating abdominal cavity. Peritoneum contained 4 or 5 coagula, stomach protruded through wound, contained half-digested rice and *dāl*. Spleen escaped through wound, completely divided in two parts transversely.

Liver.—Rupture of the liver is usually the result of extreme violence accidentally applied, such as buller accidents, or when body is run over by a motor car. There is reason to suppose that in very exceptional cases recovery may take place after a slight rupture of this viscus, and also that in very exceptional cases rupture of the liver may occur during life, without application of external violence. Non-accidental rupture of the liver may be caused without a weapon. Harvey, for example, mentions a case where it was ruptured by a kick, and two others in which the rupture was caused by kneading with the knees and elbows, or '*kāl kani*'.

Rupture of the liver may occur from violence inflicted during life, without any external marks of injury being left. In about one-fifth of the Bengal cases no external marks of injury were present. Considerable power of locomotion may remain after receipt of the injury. Taylor remarks, that unless the large veins at the back of the liver are injured, bleeding from a ruptured liver may occur only slowly, and the patient survive some time; but thereafter die rapidly from sudden copious effusion of blood, caused by muscular exertion, or fresh violence. The same author mentions one case of survival for eight days, and two of survival for ten days, after rupture of the liver.

In 33 cases Dr. Coull Mackenzie found the cause to be —14 cases by being knocked down by runaway horses in or outside carriages and by bullock carts; 8 resulted from falls into the holds of ships and boats, 2 resulted from falls on piles of bricks, 1 was a man knocked down while helping to remove a boiler—the boiler rolled on his back and crushed him to death; 1 was that of a man struck by a tub full of salt, which was being removed from a ship's hold, 1 a porter, who, while carrying a heavy box on his head, slipped and fell on his back with the box on the front of his chest and abdomen; 1 was a man, who, while working on board a ship, was struck by a sling containing three 2 maund bags of *dal*, 1, a drunken man, fell heavily on a hard metal rod; 1, a sals kicked over the abdomen by a horse he was grooming; 1, a lad in a fishing boat which collided with a pontoon of the Hughli Bridge, was precipitated into the river, and either was driven by the current against the pontoon, or its mooring chains a few yards below, 1 was a man struck by the handle of a winch in motion.

Death was reported to have occurred instantaneously in 11, or 32·8 per cent, within an hour; in 4, or 11·7 per cent., in from one to two hours; in 1, or 2·9 per cent, from two to three hours, in 4, or 11·7 per cent., in three to seven hours; in 1, or 2·9 per cent., in three days, and in 7, or 20·5 per cent, the time was not mentioned by the police authorities

Liver.—Prof Powell reports "A motor-car on the 26th July, 1915, the
He died eight days later when I found

"In 1902 a clerk was seen to walk about twenty yards and then lie down on a bench in Colaba Railway Station. He shortly after died. *Post mortem* I found the liver crushed into several pieces, one piece

had walked unaided to the bench, but subsequent experience of many cases of rupture of the liver in motor-car and other accidents has now convinced me that the statements of the eye-witnesses were quite credible."

Case.—**Homicidal rupture of liver.**—In 1880 a drunken native in an altercation pushed another, Suk Chand Karmokar, who fell heavily to the ground and died "very shortly after" *Post mortem* examination showed no marks of injury on abdomen or thorax, but a rent in right lobe of liver five inches long. Liver was hard and not enlarged. Prisoner was tried for culpable homicide not amounting to murder.—Dr. Coull Mackenzie, *Ind. Med. Gaz.*, 1889, p. 229

The gall bladder may be ruptured by violence, as in a case mentioned by Harvey, in which the subject was a boy *at* five, who had been strangled, and in which the rupture was probably caused by pressure with the knees Ogston, however, remarks that "ruptures of the gall bladder proper have usually been the result of emetics given to ensure the expulsion of gall stones"

Intestines—Rupture of the intestines is usually fatal, the cause of death being commonly peritonitis, the result of extravasation of their contents. Rupture may occur solely from disease, or from violence acting on a diseased portion of the intestine, or solely from violence. Hence, when this injury is found, careful examination of the ruptured portion for signs of disease, *e.g.* ulceration or softening, is of special importance.

The position of the rupture was the upper jejunum in four cases, the lower in two, the middle in one, the ileum and the sigmoid flexure in one, in Dr Mackenzie's cases

Rupture even of a healthy portion of the intestines may occur from a comparatively slight amount of violence. The

violence causing the rupture may leave no external marks. Out of twenty five Bengal cases, in twelve external marks were absent; but in five of these, on dissection, signs of bruising were found in the subcutaneous tissues. Rupture of the intestines may be the result of accidental or non-accidental violence, seven of Harvey's cases apparently were accidental. Ten out of Mackenzie's eleven were accidental, due to horse-kicks, blows, or crushing. When non-accidental, the injury is often the result of a blow without a weapon. Usually, after the receipt of the injury, the sufferer is capable of considerable muscular exertion. For injuries to the Rectum, see p. 139.

In Dr Mackenzie's fatal cases, 1 died in 7 hours, 1 in 12 hours, 2 in 24, 1 in 29, 2 in 30, 1 in 58 hours, 1 in 3 days, and 1 each in 5 and 8 days. The cause of death was peritonitis in 9 out of the 11 cases, and shock in the 2 others.

in a hospital and went to his house, where he died about five days after the assault. The *post mortem* examination showed the organs generally to be healthy, but there was a circular rupture of the size of a threepenny piece in the lower third of the jejunum, around which lymph was extravasated. The abdomen contained 72 ounces of fecal-smelling brown fluid, and there was acute peritonitis. Death was reported due to peritonitis following rupture of intestine. The two Chinamen were tried on two counts—culpable homicide not amounting to murder, and doing a rash and negligent act, but were acquitted by the jury on both charges.—Dr. C. Mackenzie, *Ind. Med. Gaz.*, 1890, p. 70.

Stomach.—This viscus is liable to rupture from disease. Cases also are recorded of rupture from over-distention and violent ineffectual efforts to vomit, and of spontaneous rupture without any very apparent cause. Taylor mentions a case in which rupture both of the stomach and the spleen occurred from a fall of about twenty feet, and in which no bruises or other external signs of injury were present. In one of Harvey's cases, also, although there was a fracture of the skull, and bruises on various

injury be present.

Pancreas.—Injury to this viscus from external violence is very rare. McLeod and Harvey, however, each mentions a case; in the first the viscus was ruptured, but no external marks of injury were present; in the second the viscus was "injured," and contusions, not visible

externally, were present on both sides of the spine. In both, the injury appears to have been caused by kicks or trampling with the feet.

Kidneys.—Rupture of the kidney solely from disease is extremely rare. Disease or abnormal formation of this viscus may, however, conduce to rupture from violence. Rupture of the kidney usually occurs only from great violence, and hence is often accompanied by other lesions. Notwithstanding this, in nearly one half of the cases, signs of external violence over the region of the kidneys were absent. In sixteen of Harvey's cases, the nature of the violence causing the rupture was stated. This was in eight, blows from blunt weapons, in two, kicks; in one, trampling; and five resulted from falls from a height. Two accidental cases are reported by Dr. Mackenzie (*Ind. Med. Gaz.*, 1890, p. 205).

receipt of the injury.

Bladder.—In rare cases, rupture of the bladder occurs solely from disease, either of the bladder itself or disease, *e.g.* paralysis or stricture, leading to cause of tendred or of injury are to be found. Also injury is usually caused by falls or peritonitis take *e.g.* a fall or non-acc. the bladder sometimes occurs from pressure of the child's head on the urethra, causing over-distention during delivery.

injury being present. The uterus often apparently escapes injury, even

cavity should in such cases be carefully searched for an embryo.

1.

3 three cases of
In one—caused
bruising of the
In another—the
fractured; and in
mentions a case

of probable rupture of the splenic vein.

External genitals.—(a) *The male genitals.*—Severe contusions may cause death, or severe compression of the testicles may prove fatal from shock.

Seizing by the testicles is a common method of assault in India, and Chevers mentions a case in which a man dragged another along in this way with such violence "that the whole perineal integument was torn away." Incised wounds may be attended with severe and even fatal hemorrhage, or by extravasation of urine, ultimately terminating fatally. Incised wounds, amputation of the penis, even removing the whole of the external genitals, are sometimes self-inflicted; generally, however, in such cases the individual is insane, but individuals apparently perfectly sane may mutilate themselves by cutting off a portion of the penis. In India, removal of the male genital organs used formerly to be largely practised, in order to manufacture eunuchs for immoral purposes. Young boys were generally selected, and a clean sweep made of the whole of the organs. Chevers, on the authority of Dr Eiden, appears to consider that, in 1870, this practice still existed extensively in the Rajputana States, and Harvey (1871-72) mentions the case of "a Chammar boy, aged eight, at Banisal, whose genitals were completely cut away, probably to fit him for the duties of a eunuch." Cases of this kind excluded, incised

in-law, who wished to take liberties with her." He also mentions an exceptional case, in which a eunuch possessed of a penis had it shaved off by some of his fellow eunuchs, apparently from motives of jealousy.

Case.—A 'playful' kick on a boy's perineum is reported by Dr. A. Powell to have caused death by rupture of urethra with extravasation of urine.

Case—**Branding of Vulva**—Prof Powell reports having seen three cases of branding of vulva with a red-hot *dhao* or knife, as punishment for suspected infidelity, and one case as a prophylactic on the Crusader's principle of the iron drawers.

(b) *The female genitals*—Incised, or even contused wounds of these may prove fatal from loss of blood. Some years ago several cases

are not uncommon. Harvey states that twenty-five such cases, ten of them fatal, were included in the Bengal, etc., returns for 1870-72. Sometimes such injuries are inflicted after rape has been committed. Similar injuries are sometimes produced in attempts to procure abortion.

Case—Death from a kick on the vulva. A woman, *et* thirty six while in a stooping posture was kicked by her husband in the lower part of the abdomen and died in about an hour from loss of blood. There was no injury to the vagina or uterus. There was a wound about 1 inch long and $\frac{1}{2}$ inch deep, situated at the edge of the vulva, extending from the pubes along the rami. The left crus clitoridis was crushed throughout its length, and from this the fatal hemorrhage had taken place.—Taylor, *Med Jur.* 1 67⁴

Rectum.—Thrusting a stick or other similar object into the anus is a mode of torture or murder occasionally resorted to in India, and the threat to do this is a very common form of abuse. Injuries produced in this way may cause death. Fifteen cases—eleven of them fatal—of the infliction of this form of violence were included in the three years returns for Bengal, &c., reported on by Harvey. Very often other injuries accompany this form of violence. An individual, for example, is attacked and violently beaten by several others, and finally thrown down and subjected to it. In the majority of such assaults, the victim is a male, and the motive leading to the infliction of the injuries appears to be most commonly punishment for adultery or theft. Possibly, also, in some cases, the injury is connected with sodomy, in the same way as similar injuries to the vagina are sometimes connected with rape. Chevers mentions a case, in which several children, of about eight or nine years old, threw down a boy, one of their number, and killed him by thrusting a small stick into his rectum; and Harvey mentions a similar

sometimes the result of an act of sodomy (see 'Sodomy').

Extremities.—Injuries to the extremities vary greatly in gravity, according to their situation and extent. Death may result if a large vessel is wounded, directly from loss of blood, or, if the injury is severe, from shock; and slight injuries may contribute to the production of fatal shock in cases where it

Again, injuries to the extremities may lead to inflammation and exhaustion, large vessels or nerves are divided by similar consequences. Injuries to the extremities may result in amputation, or permanently impairing their power, of course amount to grievous hurt. Obviously, injuries to the extremities may be accidental, or self inflicted. No further remarks are called for here in regard to

wounds of the ears or nose, usually indicates punishment for adultery or for theft, as the motive leading to the infliction of the injury.

In the cases of torture by *Bans-dola* (see also p. 128), or crushing by bamboos being forcibly rolled over the chest, there may be, if the body is fresh, no external marks of injury, yet the ribs may be broken and the lungs lacerated.

CHAPTER V.

HOMICIDAL WOUNDS v. SUICIDAL OR SELF-INFLICTED.

Is the wound '*accidental*,' '*self-inflicted*,' including '*suicidal*,' or inflicted by another, '*homicidal*'? The importance of this question is obvious. In considering it we must remember that in India severe, even mortal, injuries are sometimes inflicted on an individual with his consent, by another or others, for the purpose of supporting a false charge.

*Case.—Wounds inflicted by consent in support of false charges.—*Chevrens (*Med. Jur.*, p. 358) states on the authority of Mr. Perceval that at

confession led to their arrest."

the injury, to first of all accuse them (A B and others) of the assault, and then to make a pretended confession that this was a false charge brought at the instigation of C D and others. This programme was carried out, E very nearly dying, owing to the severity of the wounds inflicted on him, and C D and others were convicted of instigating E to bring a false charge against A B and others. After C D and others

individual demanding payment of the promised reward! And it was principally by proof of this fact, that the real truth came out.

Case—Murder to support a false charge.—Reg. v. Muhammad Amanji and Husan Amanji (Bo. H. C. Rep., Vol VIII., 1871, p. 110)—A summary of the main facts in this case and two others connected with it (*Reg. v. Muhammad Valli* and *Reg. v. Alibhai Mitha*) is as follows—It appeared that two factions existed in the village of Karnar in the Broach Collectorate—A and B. Alibhai Mitha and Muhammad Amanji were members of faction A, and Muhammad Valli

Mitha's old mother), and take her into Broach as a sort of make-weight against the broken head on the side of faction B. This was done apparently with the consent of the sufferer, and a false charge laid against faction B. While Alibhai's mother was in hospital, Alibhai's faction (faction A) held another consultation, the result of which was that they determined to poison Alibhai's mother in order to have a death on their side instead of simply a broken head. Accordingly they put arsenic into some food, gave it to the old woman, who thereupon was attacked by violent vomiting, which it was stated brought on rupture of the spleen, from which she died. On this Muhammad Valli (a member of faction B) brought his sister out of his father's house and killed her by striking her on the head with an axe. She was heard just before she was struck to say, "Why do you kill me for other people?" Muhammad Valli then dashed his own head violently against a wall—all this appears to have taken place in presence of the girl's father and other witnesses—

to doubt. In giving judgment, Gibbs, J., remarked: "The evidence shows . . . that there are two factions in this village, and that murders have been committed on each side—not, as would be naturally expected, by members of one faction on a member of the other, but by members of one faction on a helpless female of their own, so as to throw either the guilt of blood or the blame of the crime on the other party. Such a state of things is hardly credible, but this is an instance of truth being stranger than fiction."

Homicide.

Homicide, or the murder of a human being, is the most serious of all crimes, and it is punished as such under British law in India, where life tends to be held rather cheaply.

Causes of homicide in India.—The causes which lead a man in India to commit murder are often trivial in themselves.

They usually originate in quarrels about land and women, or in robbery and malice.

1 Connected with sexual relations—Under this head may be noticed as more or less common in India (a) Murder of *husband by the wife*, here the motive is usually either revenge for ill-treatment or the facilitation of an intrigue, and very frequently poison—often in the latter class of cases supplied by the paramour—is the means resorted to; though in some cases the poison is given as an aphrodisiac or love-philter, and not with homicidal intent. (b) Murder by way of punishment for *adultery* here mutilation of the body of the victim often accompanies the murder: mutilation of the nose, ears, lips, etc., is a not uncommon method of punishing a woman for sexual infidelity. (c) Murder of women pregnant from *illicit intercourse*: in such cases the victim is frequently a Hindu widow (a victim of the custom which prevents the remarriage of child-widows), and very often the fatal result is a consequence of injuries inflicted for the purpose of procuring criminal abortion (*q.v.*). (d) *Infanticide* (*q.v.*), also frequently the result of the Hindu restriction on child-widows. (e) Murder of females after violation, or *rape* (*q.v.*): the victim being in some instances a young girl, in others an adult female. Young children (omitting Hun cases in war) are raped first, and murdered afterwards, to destroy evidence. Adults are first murdered to overcome resistance and then raped, as a rule.

2. Connected with acquisition of property.—More or less common examples of this are: (a) Homicide arising out of disputes in regard to the possession of land. Often such disputes lead to affrays, in which clubs and other blunt weapons are freely used with fatal results. (b) Death from injuries inflicted by a gang of robbers or *dacoits*,¹ the injury being sometimes inflicted by way of torture, often by burning, in order to extort information as to the place in which money or valuables have been hidden. (c) Murder of young children for the sake of the ornaments worn by them. This is a variety of homicide of tolerably frequent occurrence in India. (d) '*Thuggi*' or highway robbery accompanied by homicide. The description of murder used formerly to be often met with in India, strangulation being the means commonly employed. *Thuggi*, however,

empt to commit,
y committing, or
aiding such com-
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1. 391.

is now rare, and in such cases as now occur, the death of the victim is usually the result of drugging, datura being the agent commonly used. (c) Murder by way of punishment for theft is not infrequently met with in India in which thieves caught in the act are set upon and violently beaten, perhaps killed.

3. **Sacrificial.**—Human sacrifice as a religious rite, several cases of which are mentioned by Chevers, formerly widely prevailed in India, but has now been largely suppressed, though it has been on the increase in India in the past few years (1917). The same may be said of the practice of 'sati,' or widow burning, before alluded to, and of the practice of burying widows alive in their husbands' graves, formerly prevalent among certain castes. Cases of homicide connected with superstition still, however, occasionally occur in India, *eg.* the killing of individuals suspected of witchcraft, and cases in which death results from the subjection of the victim to an ordeal for the discovery of theft (see *case*, p. 31), or of supposed practice of witchcraft (see 'Drowning,' Chap. VI.) A case of a father sacrificing his son occurred in Bombay in 1901, and another in 1916.

4. **Murder of infants.**—The peculiar features and modes of detecting this crime in India are described under 'Infanticide,' Chap. XII.

The Victims of criminal homicide are often unoffending persons. Murder cases often occur in India in which the victims are numerous, and include children or others who have given the murderer no offence. In cases of arsenical poisoning, for example, the victims are often several in number, some being children; and often in such cases the injury to avenge which the murder is committed is of a very trifling character. Again, in 'running amok' cases, it frequently happens that some or all of the victims are unoffending persons. Cases also are sometimes met with in India in which an individual, in order to revenge himself on an enemy, kills some unoffending person, sometimes a relation or friend, solely for the purpose of bringing a false charge of murder against the person who has injured him.

Homicide with consent of victim. In India it sometimes happens in a case of homicide that the individual killed has consented to suffer death. Thus, for example, in the cases of homicide for accusation just referred to, the victim is sometimes

a consenting party to the crime. The custom of the burying alive—'*samaith*'—of lepers, which formerly was widely prevalent in India, affords another example of this description of homicide, as, at any rate in the great majority of cases, the sufferer used to be a consenting party.

Suicide.

Suicide, or 'self-murder,' is regarded by the law as murder, a murder committed by a man on himself; and the distinctions between murder and manslaughter apply also to this. So fully is suicide held to be murder, that every one who aids or abets suicide is guilty of murder.¹ It is in law the same as *felo-de-se* or felony committed on one's self. The expression usually added to the verdict of suicide, namely, 'whilst temporarily insane,' is a legal contradiction, for an insane is held to be incapable of murder, or indeed any criminal act, either upon himself or another.² This expression is regarded as a charitable addition to relieve the suicide and his family from the stigma and other penalties of the crime, and for recovering the monies of life assurance.

Curiously enough, although suicide is self-murder, yet an 'attempt to commit' suicide is *not* an attempt to commit murder, but a common misdemeanour (*Regina v. Duddy*, 6 Cox C. C. 463).

Causation of Suicide and Suicidal Mania.

It is generally considered that every person who commits or attempts to commit suicide must be insane, at least, momentarily, when they have reached that complexity of mind in attempting to slay himself or herself; but by far the great majority of suicides occur in those who kill themselves without having shown signs of insanity, or such marked signs as would have warranted their restraint by law. Suicidal propensities occur in all forms of insanity, in maniacal, melancholic, and also monomaniacal; but although the onset of suicidal tendencies is readily noticed in insane patients of asylums and precautions are taken accordingly, in civil life these premonitory signs usually pass more or less unnoticed.

What are the incentives to suicide?—The most practical answer to this question that we know of is given by Dr. Wynn

¹ Sir Jas. F. Stephen, *Hist. of Crim. Law*, 1883, III., 104.

² R. H. Wellington, *Trans. Med. Leg. Soc.*, 1903, I., 82.

Westcott, and although his experience lay in London it nevertheless helps us to understand the inner causes of Indian suicide. He says¹ the conditions of life which make life unbearable to the suicide "are very various, seldom single, and often complex. The sufferers from misfortune, passious, disappointments, fear, and pain, although not insane in a legal sense, do essentially differ from those neighbours who do consent to live from day to day under mental or bodily suffering until released by the return of peace and happiness, or by a natural death. It is not possible to define the difference between these two types of person, but the essential difference does exist, and has been the subject of great controversy"; some believing it to be the difference between the pessimist and the optimist, the true believer and the unbeliever, the coward and the brave man. "Some doctors say," continues Dr. Westcott, "that the distinction is based on heredity, or, at any rate, that an instability of character is founded on an imperfect or faulty material basis in the brain and nervous system . . . nor can the characteristic tendencies of the defective state be recognized by symptoms, unless the blot upon the brain be so deep as insanity."

The proximate causes of suicide, in Dr. Westcott's long practical study of the subject in London, appear to be seldom solitary. "*In the majority of cases we have found that the sufferer has tolerated much discomfort, pain, or sin, for a long period, and then has succumbed to an added grievance, or to the onset of an overmastering passion. So that we are able to refer to the basic absence of sufficient *vis vitæ* or the determination to survive; and in addition, to a secondary cause, such as alcoholism, bodily disease, or poverty; and then to a final cause, such as a fit of passion, an attack of pain, or a disappointment in love. In ordinary cases of suicide it is not practicable to obtain sufficient details of life-history to decide on secondary and final causes with accuracy,*" only approximately.

Direct causes of suicide.—In England, according to Dr. Westcott, "next to alcoholic excess (with its loss of occupation, money troubles,

¹ "On Suicide," *Trans. Med. Leg. Soc.*, II. pp. 87, etc

family and unfortunate love affairs, and everything that lessens human prosperity affects the mind prejudicially and encourages self-destruction.¹ In France, out of 5922 suicides,² $\frac{1}{4}$ were alleged to be due to mental disorder, $\frac{1}{4}$ to domestic troubles, $\frac{1}{4}$ to alcoholism, $\frac{1}{4}$ to poverty and misery, $\frac{1}{4}$ to pain and remorse, $\frac{1}{4}$ to unrestrained passions, $\frac{1}{4}$ to remorse and fear of retribution, and $\frac{1}{4}$ were unclassified.

Causes in India of suicide.—Like the Romans, the Indians approve of suicide under certain conditions—the Greeks did not, and it is curious that the Greek view should agree with the Christian practice in abhorring suicide.

Pythagoras and Socrates took the sentry view of life. the sentry duty might be bitter and laborious, but man has been placed on guard by one of his superior officers—the gods, and was guilty of desertion if he voluntarily quitted his post. On the other hand, the Roman Epicureans held that if life became no longer enjoyable death was the wiser alternative. The Stoics based their approval of suicide on severer and nobler grounds. "How," argued they, "could a man live according to right reason if his body was distempered by disease, his reason decayed or doting, his better will coerced by a political tyranny . . . perhaps crushed

by poverty, pain and poverty and domination

In modern times, however, amongst civilized nations, there is a tendency to halt between these two extremes, in that whilst discouraging self-destruction, practically no legal penalties are attached to suicide or attempted suicide in Europe or America, although abetment of suicide is held to be equivalent to murder in England. In India an attempt at suicide is an 'offence.'

For India the following causes of suicide deserve special mention, from their frequency, or peculiar character, and it should be noticed that most of these are also alleged causes of insanity.

Domestic troubles and worries.—The mental distress arising out of quarrels with their husbands, or husbands' relatives, often of a trifling character, is a common cause of the suicide of wives in India; and similar domestic differences are also a not uncommon cause of the self-destruction of the husband.

Remorse and shame.—This is not an infrequent cause of self-murder amongst Hindu women as a result of illegitimate

¹ "On Suicide," *Trans. Med. Leg. Soc.*, II. p. 91.

² Analyzed by J. F. Kolb in his *The Condition of the Natives*, quoted by Westcott, *ibid.*, p. 83.

relations consequent on the custom of enforced child widowhood (see cases in Chaps XIII and XIV.); and it also operates in cases of unrestrained passion, jealousy, and indulgence in debauchery, and fear of arrest on criminal charges.

Venereal Disease is a frequent cause of suicide. So much so is this, that Professor Powell states, "In otherwise inexplicable cases of suicide I instinctively examine the penis, venereal disease being a common cause of suicide, sometimes from syphilophobia, more often in cases of persons engaged to be married, or in married men whose wives are expected back from home or the 'Hills' after a prolonged absence."

Fanatic, religious, and imitative.—Self-destruction from religious motives was formerly of somewhat frequent occurrence in India. One variety of this form of suicide consisted in the individual offering himself as sacrifice, in order to propitiate one of the Hindu deities, as, for example, by casting himself under the wheels of the car of Jaggarnath, or drowning himself in the Ganges. No doubt, also, in some cases of '*sati*,' or burning of widows on the funeral pile of their husbands, formerly of frequent occurrence in India, the victim was a consenting party, willingly or unwillingly. Several forms of religious suicide have been detailed on pp 30, 32.

Suicide by children is not uncommon in India. Out of 1716 suicides in Bengal 23 were children, and out of 4172 in Oudh 46 were children. The means by which suicide is usually committed has already been detailed.

The verdict "suicide while in a state of temporary insanity," so frequently returned by coroners' juries in England, is most probably in many cases the result of the fact that, by the law of England, self-destruction (in a person of sound mind) is a felony (*felo-de-se*) or murder entailing forfeiture of goods and burial in unconsecrated ground, unless the suicide be declared to be of unsound mind, and the average English juror

be the duty of coroners in India to inquire whether any person dying by his own hand was or was not *felo-de-se*, and further that a *felo-de-se* shall not forfeit his goods.

Frequency.—In England, suicide, which forms about one-tenth of the reported violent deaths, is over 100 per million of population, and is, as in all civilized countries, steadily increasing, the rate having progressively increased from 66 per million in 1861 to 105 in 1903.

London itself has a rate of only about 90 per million living persons, and has always had a smaller rate than foreign cities, which have been estimated to have the following suicide rate per million living—Paris, 400, Stockholm, 350, Copenhagen, 302, Vienna, 280, Brussels, 270, St. Petersburg, 206; Berlin, 170, New York, 150.¹

In India the reported annual death rate from suicide, according to Dr. K. McLeod, ranges from about 50 to 80 per million of population, except in Bengal and the Punjab, which are reported much less.

The sexual ratio differs remarkably in English and Indian suicide statistics, in that while in England the suicide death rate among males is three times as high as among females (for the eight years 1887-1905 the proportion is almost exactly 3 to 1), in the different Indian provinces the female suicide rate exceeds the corresponding male rate. Thus in the Madras Presidency, where the rates for the two sexes differ least, the female suicide rate is about one-tenth higher than the male rate; while in the United Provinces, where the rates differ most, the female suicide death rate is on an average about two and a half times as high as the male rate.

SUICIDES ACCORDING TO SEX PER 1,000 CASES (McLEOD).

Method	In Calcutta.		In Provinces	
	Males	Females	Males	Females
Hanging	179	346	368	278
Drowning	127	54	354	576
Poison	547	562	163	119
Cuts and stabs	59	16	65	11
Gunshot	37	—	25	—
Otherwise	51	22	20	16

Age.—The suicide rate increases, as in England, from puberty up to fifty or so, and then declines. Child suicide is not uncommon in India.

Mode of Suicide.—The means of suicide vary according to local conditions, such as the presence of a river or lake, or accessibility of weapons or fire-arms, poison, etc. In India, the means chiefly employed are (1) drowning, (2) hanging, and (3) poison. *Drowning* is the mode selected by about

¹ Dr. W. Wynn Westcott, *Trans. Med. Leg. Soc.*, 1904, II. 65.

three-fourths of the female suicides of the Madras and Bombay Presidencies, while more than three-fourths of the male suicides in the same provinces hang or drown themselves in about equal numbers. In the Panjab one-half the male and nearly one-half of the female suicides choose *hanging*, while drowning is selected by only about one-third of the females and one-sixth of the males. Hanging, also, is the mode chosen by over half of the female and about one-third of the male suicides of Calcutta. *Poison*, usually arsenic or opium, is chiefly used as a means of suicide in certain special localities, *e.g.* in districts where the poppy is grown, and in the towns of Calcutta and Bombay. For details of suicide by poison, see 'Poisons.' *Gunshot* is more commonly used by Europeans and Eurasians.

The difference in the mode of death selected by would-be suicides in different parts of India is seen in the following table, from which it will be seen that whereas in Calcutta the favourite means is poison, in other parts of India the preference is for hanging, then drowning, and thirdly poison, whilst females prefer drowning, then hanging and less frequently poison.

MODE OF SUICIDE IN 1000 SUICIDES OF EACH SEX¹

Mode.		England and Wales, 1874 and 1876	Bombay Presidency, 1873 to 1876	Madras Presidency, 1872 to 1876	Panjab (two years, 1872 and 1876)	Calcutta (Town), 1872 to 1876	Madras (Town), 1872 to 1876
Males	Hanging	274	382	471	500	326	163
	Drowning	184	456	443	174	74	623
	Poison	90	91	26	184	453	86
	Cuts, stabs, etc.	280	71	49	26	84	96
	Gunshot	82			32	63	32
	Otherwise	90	—	11	84	—	—
Females	Hanging	284	185	179	464	519	42
	Drowning	309	767	790	354	26	937
	Poison	155	37	26	84	429	21
	Cuts, stabs, etc.	182	11	2	18	26	—
	Gunshot	2			—	—	—
	Otherwise	68	—	3	80	—	—

The various forms of suicide and questions therewith are detailed under the respective modes of fatal violence, wounds, etc.

¹ K. McLeod, *On Suicide in India*.



SELF-INFLICTED WOUNDS, FEIGNING ATTEMPTED HOMICIDAL WOUNDS
(On left upper arm)

Is the Wound Homicidal or Suicidal or Self-inflicted?

This question is answered by: (1) The *appearance* and *position* of the wound. (2) The *direction* of the wound. (3) The *number* of wounds or injuries. (4) The *position and surroundings* of the injured individual.

1. Appearance and Position of the Wound.

Although in many cases, these characters afford no indication as to how, or by whom, the injury was inflicted, a presumption more or less strong arises from the following circumstances —

Against self-infliction and in favour of homicide or accident, in the case of stabs passing right through the body, and cut throat extending to the vertebrae, these being rarely self-inflicted wounds

Case.—Suicidal cut throat, wounding vertebra.—Dr. A. Powell relates a case of a European who committed suicide with a razor and hacked the vertebra without wounding the carotids. He did this by throwing his head back during the operation. In this position the carotids are on a plane posterior to the anterior surface of the vertebra.

Case.—A Hindu male, aged 35, committed suicide in the court lock-up, Bankipore, on 17th July, 1897, by cutting his throat with a knife. His body was examined the same day. Marks of injuries: a transverse incised wound in front of the neck, about five inches long and four inches broad, down to the spinal column; the trachea was divided
 1 carotid
 2 vessels

ons two
 the first
 3 vessels

of the neck were unwounded. In the second (Marc's case), respecting which Taylor remarks that a wound so extensive is rarely seen in a case of suicide, the large vessels were wounded, the windpipe and gullet cut through, and the vertebra grazed.

So also stabs, and incised wounds on the back, and gunshot wounds, unaccompanied by any blackening of the skin or scorching of the clothes, are only likely to be self-inflicted if some special contrivance has been used to fix, or in the case of a gunshot wound to fix and discharge from a distance, the weapon employed. Several *contused* wounds are only likely to be self-inflicted if the person is insane, or the case is one of suicide by precipitation from a height.

In favour of self-infliction.—In the case of incised wounds, if these are all slight, or if severe they tail off at one end into a superficial scratch, and are in the accessible position on the

left side in the case of a right-handed individual (see *Plate I.*), the presumption is in favour of self-infliction. In suicidal cases, in about four-fifths of the cases the head is chosen for injury.

Case.—Self-inflicted wounds feigning homicidal.—The Lansdowne Road Mystery.—Flora McL.

family in Calcutta in 1901.

and one night it was found

and alleged that a native had come into her room at midnight and stolen her jewellery, had knocked her down in the bathroom and stabbed her repeatedly and killed the child. The stabs, 14 in number, were skin deep and evidently self-inflicted. The scratches were all on the left

and considering their length, could not have been inflicted

The police believed that she produced them with the point of a pair of scissors. They were in a position where she could conveniently produce them with her right hand. The police surgeon gave it as his opinion that they were self-inflicted. The child was 16 months old and was reported to have died of suffocation. It transpired that proceedings for a divorce were being taken against accused by her husband. No trace of the alleged burglar was found.

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It, however, soon became evident that this man was the murderer. . . . His wounds were very slight, the chief one being on the thigh, about

ugh the to the greater

357.

to be very trifling, and probably self-inflicted. "She was convicted of bringing a false charge, and sentenced to six months' imprisonment."—*Harvey's Beng. Med. Leg. Rep.*, p. 117.

In favour of infliction by another person, in cases where severe incised wounds are accompanied by cuts on the hands of the injured individual, and in female subjects—if the circumstances exclude accident—in cases of wounds of the genitals, or castration, or mutilating wounds of the nose, ears, or breasts. In India, wounds in females in the situations just mentioned indicate jealousy, or punishment for adultery as the motive for their infliction; and wounds of the genitals in male subjects often also indicate the existence of the last-mentioned motive or religious monomania—as melancholics sometimes make a clean sweep of penis, scrotum, and testes. Blows or cuts on

the head inflicted by a right-handed person are usually on the left side of the victim, if on front.

In favour of accident—the location of the wound on an exposed part of the body and one side only.

2. Direction of the Wound.

It may first be noted that while a non-self-inflicted wound may have any direction, a self-inflicted wound usually has a particular direction, dependent on the part wounded and the hand employed. Hence it is important, where possible, to ascertain whether the injured individual is, or was, right or left-handed, or ambidextrous. Next, an endeavour should be made to determine the beginning and ending of the wound: this, of course, presents no difficulty in the case of punctured and non-traversing gunshot wounds. In traversing gunshot wounds, the beginning and ending of the wound are indicated by respectively the orifice of entry and the orifice of exit. It, however, by no means follows that the direction of such a wound is represented by a straight line drawn from one orifice to the other. For example, a projectile may be deflected by a bone or by tough fascia, and take a circuitous course, *e.g.* may be deflected by a rib, and pass half round the body without penetrating the chest, or pass half round the head without penetrating the skull.

Dr. A. Powell cites a case in a sergeant of the 8th Mounted Infantry in the Boer War hit by a Mauser bullet close to the spine. The entrance wound was linear. The bullet travelled right round the ribs and was removed from below the skin close to the sternum between the third and fourth costal cartilage. Had it come out of itself the exit would doubtless have been much smaller than the entrance wound.

In the case of incised wounds made by a drawing-cut, if one end is abrupt, deep, and unbifurcated, and the other shallow, and tailing off, or bifurcated, the probabilities are that the former is the beginning and the latter the ending of the wound. In deep incised wounds, the plane of the wound must be noted (see *Case*, p. 159).

Self-inflicted incised wounds, as a rule, (1) end on the same side as the hand employed, and (2) begin from below if on the lower part, or from above if on the upper part of the body. Self-inflicted incised wounds of the throat, as a rule, possess the first of these characters, but may or may not possess the second, *i.e.* they may be transverse, or run from above down,¹ or from below up. Self-inflicted stabs and gunshot

¹ K. McLeod, from the cases reported in Bengal in 1862, considers that suicidal wounds of the throat are generally high up on the neck, between the

wounds (in right-handed persons) run, as a rule, from right to left.

Homicidal wounds may have any direction, and are specially liable to have the same direction as self-inflicted wounds if the assailant was standing behind his victim, at the time of inflicting the injury (see *Case*, p. 159). Frequently in homicidal wounds the direction of the wound indicates the relative position of the assailant and victim; it must be recollected, however, that the direction of the cutting edge of some weapons is transverse to the line of the handle. This is the case in the carpenter's adze, and the mattock (*gainti*) or spade-hoe (*phaora* or *kudali*) commonly employed by cultivators in India.

3. Number of Wounds or Injuries.

A single wound or injury may be the result of accident, self-inflicted, or inflicted by another. When many wounds are present, self-infliction and accident are, to a certain extent, contra-indicated. Multiple wounds may, however, be:—

(a) **Self-inflicted**—Several incised wounds, all slight, are sometimes self-inflicted, with the object of averting suspicion (see *Case*, p. 152); or of supporting a false charge (see *Case*, p. 152). In suicidal cases also, *e.g.* cut-throat, one severe incised wound is sometimes found accompanied by other slight cuts. More than one severe incised wound may, of course, be self-inflicted, but the greater the number the stronger the indication in favour of homicide. Several contused wounds are only likely to have been self-inflicted in the case of insanes, or in cases of suicide by precipitation from a height. Suicide by precipitation excluded, self-infliction is contra-indicated, if each of two or more wounds is of such nature as to cause immediate insensibility, or immediate death. Very severe wounds, however, may not cause immediate death, or immediate insensibility, and hence the existence of two such wounds may still be consistent with self-infliction; *e.g.* Hayes Agnew concludes from recorded cases that it is possible for a suicide to shoot himself "first in the head, and within the lapso of a minute inflict a similar wound on the heart," or *vice versa*.¹ Very great caution, therefore, must be exercised in drawing a hyoid and thyroid, more on the right than on the left side, and are either

positive inference against self-infliction, simply from the fact that more than one severe wound is present on the body.

(b) **The result of accident,** *eg* a fall from a height, an accident from machinery, etc. In such a case, however, homicidal violence is not contra-indicated, unless all the injuries are to be accounted for by the supposed accident. Thus when the accident indicated is a fall from a height, and there are no projecting objects against which the body could have struck during its descent, severe injuries on both sides of the head contra-indicate accident (see *Cases*, below and p 159).

4. Position and Surroundings of Injured Individual.

Under this head should be noted :—

(1) **The position and attitude of the body and its relation to surrounding fixed or large objects.**—This may directly indicate self infliction or accident, as, for example, when the body is found at the foot of some high object, from the top of which it may have fallen. It must be borne in mind, however, that an attempt is sometimes made to conceal murder by placing the body of the victim in such a position as to point to accident or self-infliction as the cause of the injuries. With this object the body (as in *Case* below) may be placed at the foot of a high tree, or on a railway line, etc.

arm. (d) On right side of face and neck several bruises elongated in

deceased, and several others, had been stealing mangoes, when a dispute arose as to the division of the plunder, and some one knocked deceased down with a lathi. The body was then conveyed some distance (probably dragged along the ground) and placed under the tree, so that it might appear that a fall therefrom was the cause of death.—Asst.-Surg. Duncan in *McLeod's Beng. Med. Leg. Rep.*, p. 41

In such cases discrepancies between the nature and situation of the injuries, and the method of production indicated by the position of the body, point indirectly to the employment of homicidal violence. In other cases also indirect indications

of the employment of homicidal violence may be afforded by the position and attitude of the body. This is so when the injuries present are of such a nature as to make it improbable that the position and attitude in which the body was found resulted from effort on the part of the injured individual. For example, the body may be found at a distance from the place of infliction of the injury, or in an attitude widely differing from that in which it must have been in, directly after its receipt, *e.g.* the cause of death being fracture of the skull from a blow on the back of the head, the body is found in an upright position, supported against a high thick hedge at its back. The possibility, however, even when the injuries are extremely severe, of considerable effort on the part of the injured individual must not be overlooked. It has already been pointed out that a certain amount of power of voluntary movement may still be retained after receipt of very severe wounds, and it now may be pointed out that very considerable power of locomotion may remain, even after the receipt of almost immediately mortal injuries.

Case.—Locomotion after mortal injuries.—Dr. A. Powell relates a recent case, in which a boy of 18 ran at least 120 yards from where he was mortally shot through the heart. *Post mortem* examination showed that a buckshot had pierced the anterior wall of left ventricle and

penetrated.

Case.—An old man was severely beaten with a split bamboo; after the beating he walked to his house, a distance of about half a mile, and died almost immediately. On *post mortem* examination, the seventh and eighth ribs on each side were found fractured, the spleen ruptured, and the right lobe of the liver all but divided transversely by a bifurcated rupture 8 inches long and $1\frac{1}{2}$ inches deep and broad.—*Ind. Med. Gaz.*, 1867, p. 200, Dr. Hutchinson.

(2) Condition of surface of the body, or of the clothes or other coverings thereof.—Important points to note under this head are: (a) Peculiarities of the clothes likely to have modified the injury received, or to affect the condition of the weapon used, *e.g.* a thick turban may cause a severe blow from a blunt weapon to produce a simple, instead of a compound, fracture of the skull; or fibres derived from an article of clothing worn over the injured part, may be found adhering to a weapon, and thus indicate it to be the one which was used. (b) Stains of blood or other matters. It is possible that these by their nature or position may indicate homicidal violence, *e.g.* stains of seminal fluid on the clothes or body of a female corpse, or a mark of a bloody right hand on the right hand or arm of injured

(3) Nature, position, and condition of objects on and near the spot where the body was found, or the injury inflicted.—The objects found may be weapons, sharp stones, articles of clothing, fragments of clothes, etc., and these or other objects may bear stains of blood. Again, near the body or place of injury may be found bullet-marks, footprints of persons other than the deceased, or marks indicating that a struggle has taken place. If a weapon is found, its position is of importance. This may indicate self-infliction, as, for example, when the weapon used is found tightly grasped in the hand of the dead body, as already instanced. A weapon, however, found loosely lying in the hand of a dead body, may have been placed there, with the view of fabricating evidence in favour of suicide (see *Case*, p. 159). The discovery of the weapon used, at a distance from the body, indicates homicide, in proportion to the improbability of its having been placed where it was found, by the deceased. Here, obviously, the question of what power of effort or locomotion remained to the deceased after receipt of the injury, must be considered. As regards the nature and condition of the weapon found, it may be pointed out that peculiarities in its shape, etc., by their agreement with the shape of the wounds on the body, may indicate it to be the weapon which has been used, and this again may be confirmed by the weapon showing signs of recent use. Marks, again, indicating ownership, present on the weapon, may be important as evidence in favour of the guilt or innocent weapon used, as

rapid death or 1
regards sharp stones, the presence or absence of these is of importance as indicating the possibility or otherwise of the injuries being caused by forcible accidental contact therewith.

A compound fracture of the skull, for example, a common result of a blow with a blunt weapon, may be caused by a fall on a sharp stone, but is an exceptional result of a fall on a flat surface¹. As regards articles of clothing or fragments of clothes, the presence of these near the body, or grasped in the hands of the deceased, may indicate that a struggle took place shortly before death between the deceased and some other person, and thus indicate homicide. Fragments of hair, again, belonging or not belonging to the injured person, may be found in similar situations, or adhering to weapons, and may prove of much importance in evidence. Stains of blood may be found on a weapon indicating its recent use, or on other objects in the neighbourhood of the body or the spot where the injury was inflicted. Sometimes the appearance and position of such stains is important as indicating the circumstances under which the injury was inflicted (see *Cases*, pp. 153 and 159).

Case.—Circumstances under which wounds were inflicted inferred from position and form of blood spots.—In the case of Spicer, a woman was killed by a fall down a stair, fracturing her skull and

Jur., I. p. 549.

Bullet-marks or shot-holes, by their situation, may indicate the position of the assailant at the time the weapon was discharged (see *Cases* below). The distance at which the shot was fired is usually related to the question of premeditation, as it is manifest that a shot fired from a considerable distance could not have been fired in the heat of a sudden quarrel.

Case.—"Sir Astley Cooper, called to see Mr. Blight, of Deptford,

¹ *Eng Med Leg. Rep.*, p. 53

As regards footprints, Ogston¹ remarks that the impression left by the naked foot varies in the same individual according as to whether he was standing, walking, or running at the time. Lastly, objects in the neighbourhood may be found overturned, broken, or showing marks of injury, pointing to a struggle having taken place.

As an illustration of the application of many of these points to a particular case, which in itself exhibits many points of interest, the analysis of the case of the *Empress v. Sudhabode*, by Dr. E. G. Russell,² is interesting also as a case of special pleading for the prosecution.

Some of the obvious defects of Dr. Russell's reasoning are pointed out in remarks enclosed within square brackets. He does not appreciate the fact of the extreme rarity of "cadaveric spasm"; nor does Taylor if by "thus frequently" (p. 164) he refers to cadaveric spasm. It is true the profession recognizes the extreme rarity of cadaveric spasm. Nor does he think it probable that a razor could be notched by striking the bone in suicidal cases; whereas Professor Powell has cited a case of a razor notched by undoubted suicides in which he found the steel fragments embedded in the vertebra. Nor can anything be inferred from the "expression" of a corpse; the muscles of expression relax in death, and practically all faces are placid unless decomposition has set in, or the jaw has dropped—phenomena which have nothing to do with the passions or temper of the man immediately before death.

Case.—Fabrication of evidence of Suicide in Homicidal cut-throat.—*Imp. v. Sudhabode Bhattacharyi.*—A native girl, aged 11 years, was found dead in her bed with her throat cut, and a blood stained razor in her right hand. She and her husband had retired to their bedroom at 10 P.M. on the 12th September (1888); the husband left the house at 4 A.M. on the 13th; information of the girl's death was given to the police at about 1.30 P.M. on the 13th. *Post mortem* examination was held at 7.30 A.M. on 14th.

THE POINTS WORTHY OF SPECIAL NOTICE WERE:—

1. [The wounds were not fresh] 2. [The wounds were not fresh] 3. [The wounds were not fresh]
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94. [The wounds were not fresh] 95. [The wounds were not fresh] 96. [The wounds were not fresh]
97. [The wounds were not fresh] 98. [The wounds were not fresh] 99. [The wounds were not fresh]
100. [The wounds were not fresh]

¹ *Lect. on Med. Jur.*, p. 63.

² *Ind. Med. Gaz.*, 1889, pp. 33, etc.

of neck marked by *one* incision only like those on left side; tracheal wound also single.

5. Plane of wound upwards, direction transverse, crescent-shaped; both ends equally high.

6 *Rigor mortis* well marked and universal, both hands in identically same attitude as regards fingers, and firmly fixed so by *rigor mortis*.

7. Razor loose in right hand, not clasped or even touched by the fingers

POINTS ESTABLISHING HOMICIDE.—I Wounds—(a) Severity (b) Order. (c) Direction (d) Redundancy (e) Plane (f) Lowness on neck. (g) Regularity II The bleeding.—(a) Direction (b) Nature of stains on right hand and arm and on clothes III Razor in right hand—value of this fact IV. Death almost instantaneous V Wounds were inflicted during life, and were the cause of death VI Absence of cries and of signs of struggle Each of these points deserve separate consideration.

I. Wounds—(a) The severity. The head was nearly cut off; both common carotid arteries, both internal jugular veins, the pneumogastric and phrenic nerves on both sides, all the muscles of front and sides of the neck were divided, as were the trachea and œsophagus; the cervical spine was cut In addition to this wound, there were two others, each reaching to and wounding the spine It will be shown (b) that the upper and great wound, which divided every structure of front and both sides of the neck, was probably the first inflicted. After infliction of such a wound, could deceased have inflicted two others, each penetrating to and wounding the spine, and each involving a distinct and determined act of volition? Taking the wounds in any other order, could a suicide have inflicted the two others after

of female suicides in India, especially of those of tender years, is to

and must certainly have exerted a degree of muscular strength which the deceased, an immature, non-muscular girl of 11, did not in my opinion possess. In most of the cases in which exceptionally severe injuries have

been self-inflicted—more especially by women—the weapon has been a knife with a fixed handle, lending itself readily to a firm grip—not a razor, with a loose blade (See below) It will be instructive to compare with the present case, certain others which are collected by Taylor as typical of exceptionally severe injury in cut-throat cases.

Case—Suicidal cut-throat.—Woman; spine wounded in two places, but through muscles of back and of side of neck; left internal jugular vein opened; all other large vessels escaped, and all the large nerves, other incisions. (Taylor, 3rd Edn., 1883, Vol. I. p. 528) Note.—Person, an adult, maniacal; weapon, a table knife, &c with a firmly fixed handle

dict was one of murder
heading case "suicide."]
nerves of neck divided, &
(razor) with loosely jointed

Case.—Ryan's case—Man, three cuts on spine of neck; but both carotids and jugulars escaped, and therefore, almost necessarily, all large nerves. (*Ibid.*, p. 512) Quoted as a case of exceptionally severe injuries for a suicide—even for an adult male, probably accustomed to use of a razor.

Case—Marc's case—All muscles of front of neck, the windpipe, gullet, both jugulars, both carotid arteries divided; and the weapon had "even grazed the anterior ligaments of the spine." Taylor adds (*ibid.*, p. 513), "A wound so extensive as this is rarely seen in a case of

for any person to inflict such injuries on himself." Taylor adds: "The
tinct places . . . after [what
arteries and jugular veins had
justify this opinion. Suicide
spinal column, but that they
. . . is a proposition contrary
—*Ibid.*, p. 518.

which the jury unanimously endorsed. His Lordship, in summing up,
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of neck marked by one incision only like those on left side; tracheal wound also simple.

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7. Razor loose in right hand, not clasped or even touched by the fingers

-I Wounds—(a) Severity. (b) Order,

(c) Plane (f) Lowness on neck. (g)

Direction (h) Nature of stains on

III Razor in right hand—value of

this fact IV Death almost instantaneous V Wounds were inflicted during life, and were the cause of death VI Absence of cries and of signs of struggle. Each of these points deserve separate consideration.

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v. Edmunds). The extensive nature of the wounds must, moreover, in the present case, be considered in relation to the age, sex, and state of mind of deceased, the race tendencies, and the nature of the weapon used. Deceased was an immature, non-muscular girl of 11 years. The tendency of female suicides in India, especially of those of tender years, is to

been self-inflicted—more especially by women—the weapon has been a knife with a fixed handle, lending itself readily to a firm grip—not a razor, with a loose blade (See below) It will be instructive to compare with the present case, certain others which are collected by Taylor as typical of exceptionally severe injury in cut throat cases.

*Case—Suicidal cut-throat.—Woman; spine wounded in two places, but through muscles of back
vein opened, all other large
other incisions. (Taylor, 3rd I
an adult, maniacal; weapon, a*

dict was one of murder. [Here Dr. Russell disregards the verdict in heading case "suicide"] Compare present case —All large vessels and

razor,

neck, the windpipe,
and the weapon had
Taylor adds (*ibid.*,
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rteries and veins and

*Case.—Reg v. Edmunds—Three incisions, front of neck, all the
great vessels;
of spine, deep
Debi). Held
for any person to inflict such injuries on himself."* Taylor adds: "The
s . . . after [what
jugular veins had
opinion. Suicide
mn, but that they
opposition contrary
518.

Case.—Case of Earl of Essex.—To the effect that repeated wounds

of age I maintained the supposition—say, improbably, as it was
which the jury unanimously endorsed. His Lordship, in summing up,

observed "On this point, there was not a doubt in the world the wounds were homicidal and not suicidal"

in them, the windpipe and the divided tissues of the right side of neck had only a single incision through (or touching) them, just as those of left side had. How was this to be accounted for? It seems clear that the two lower wounds, which showed superficially a little to left of median line of neck for $\frac{1}{2}$ inch, and then disappeared into the great wound, must have found a gaping opening and dropped into it straight to the spine, which each wounded. A previous incision must have existed, and the tissues have been gaping from its retraction.

If it be assumed that either of these lower wounds was the first inflicted, then the tissues of right side of neck must have been divided by it; these had only one incision; therefore, in that case, the great

There was none. The upper margin of the great wound was clean cut and entire through its whole length. The great incision round both sides of neck was then the one first inflicted. This being granted, the improbability of deceased having been able to inflict the other two wounds is far greater than if either of the lower ones had been the first; as the former divided the structures of both sides of neck, the latter could only have divided those of the right side. Not only the great upper wound, but also the two lower ones must have been inflicted from left to right. For, had they been inflicted in reverse direction, what could have caused them to leap up almost vertically from the spine (which they cut) nearly $1\frac{1}{2}$ inches to become superficial almost at once? It was not contact with the inner end of left clavicle, for this was un-

for deceased, a right handed person, would herself have cut in that direction. The direction is that in which a right-handed person inflicting the wounds, homicidally, from behind deceased, would have made them; this fact supports the theory advanced as to the method of commission of the homicide.

(d) Redundancy and severity of the wounds was marked and far in excess of what was necessary to take life. That redundancy is far more frequent in homicidal than in suicidal wounds is well known. The frequency of cases of 'attempt to commit suicide' in the Police Courts and Hospitals is confirmatory of this question. Dr. K McLeod has shown that Indian records firmly establish this fact (*Med. Leg. Rev., Beng.*, 1869).

(c) Plane of wounds, upwards. This is rare in *suicidal* wounds, more common in homicidal ones, most common when the latter have been inflicted, from behind, on a person lying down. In the latter case, the plane of the wound is almost necessarily upwards. Proofs that the plane was, in this case, upwards —

1. Skin and soft parts.—Although retraction had greatly altered the relative position of the parts, yet, taking the upper margin of the great wound, its ends were from 1½ to 2 inches higher than its middle.

2. Tracheal wound.—This was, in front, between the 4th and 5th rings, posteriorly, it divided, obliquely upwards, the ends of 4th ring.

3. Incision of spine — Plane upwards

4. The difference in level between the wound of the trachea and those of the spine (behind it) was about 1½ to 2 inches. The tracheal wound, between 4th and 5th rings, was on a height with lower third of body of 7th cervical vertebra. "The lower wound of spine was at upper part of body of 6th cervical vertebra; the higher was on lower part of body of 5th. The wound had, in passing from windpipe backwards to spine, risen about 1½ to 2 inches. If the head of deceased had been drawn backwards at time of infliction of the wounds, this would, no doubt, account for much of the difference of level, but not, I think, for all. For, in my experiments (on the dead subject), I could not raise the level of the 5th ring of the trachea more than one inch, even by traction of the head backwards, which sufficed to draw the body along the table.

(f) Lowness in the neck of the wounds. Suicidal wounds are rarely
 on of hyoid bone or
 General experience
 (p. 512).

(g) Regularity of the wound has been held to indicate suicide by some, homicide by others. In the case of a struggle, it is probable that a homicidal wound would be irregular. But, on the other hand, "a murderer by surprising his victim from behind, . . . by directing his attack against one who is asleep . . . may easily produce a regular and clean incision of the throat."—*Ibid.*, p. 513. A suicide requires a steady nerve to make a regular, clean-cut wound, especially when a large one. Could a girl of 11 years of age be credited with the amount of nerve required to nearly decapitate herself with steadiness and regularity?

II.—The Bleeding.—(a) Direction of the blood effused. All the blood effused from the wounds of the neck had run directly backwards, towards the back, sopping with blood the posterior parts of the body and trunk. There were no marks of any stream of blood having run down the neck, chest, shoulders or clothes, i. e. in direction from head to feet. This shows that deceased must have been lying on

deceased's head was not so raised is almost certain, for had it been, even for a moment, blood would have streamed down the neck and chest or shoulders, and told the tale; for bleeding was at that time going on, the vessels having been severed. There were no marks of any such streams.

Moreover, it is rare for a suicide to cut the throat in a recumbent posture. (Taylor, Vol. I. p. 545) See also cases. *Reg. v. Courvoisier*, *Reg. v. Constance Kent*, and *Reg v Gardner*.

or on clothes of deceased. If the case had been one of suicide, the right

the hand and forearm, if naked, or the clothes, if covering them, have completely escaped being marked by such jets? They had entirely escaped.

III—Razor in right hand—value of this fact. At the time of *post mortem* examination, the razor was found loosely supported in the right hand between the upper phalanx of thumb and the palm, the fingers did not touch. The case was, however, complicated by the razor having been removed while the body was being conveyed to the dead-house, and afterwards replaced before I saw it. The Inspector, who saw the body *in situ* on the bed before removal, deposed that the razor was at that time not tightly clenched, that he removed it easily without any force, his object being to prevent it falling out and getting lost on the way. The defence strongly contested the point whether the razor could not at some earlier period than that at which I examined the body have been firmly grasped by cadaveric spasm. It was admitted that, had the razor been firmly grasped by cadaveric spasm, it would have been telling evidence in favour of suicide.

Taylor notes (Vol I p 85) " Razors and pistols are thus frequently found in the hands of suicides " Had it ever been so grasped, in the present case, it could scarcely have arisen from any cause other than the fixation by cadaveric spasm, at the moment of death, of a voluntary grip of the weapon during life. For this condition cannot be artificially induced after death. I maintained that there was proof that the weapon had never been fixed in a tight grasp by cadaveric spasm. For, had it ever been so clenched, the razor could only have come into the loose state

hand, as elsewhere, at the time of my examination. Had the fingers been unclasped, by any person, from a grasp of the knife, cadaveric rigidity (*rigor mortis*) would have, to that extent, been destroyed so far as these fingers were concerned, and, once destroyed, could not have been restored.

supervening stage of general relaxation may have loosened it, and this loosened stage have been found and fixed by supervening *rigor mortis*, and that this would explain the condition found. The answer is plain; that cadaveric spasm is *rigor mortis* (early in setting in), and that, when relaxation ensued, there would be no further (or second) *rigor mortis*. There were two other points indicating that the position of the fingers of

the right hand had not been altered by any person, namely, that the position of the fingers of both hands was identical, finger for finger, joint for joint, and that the members of both hands were in the position commonly found in death from whatever cause, i. e. thumb close to palm, its last

precisely the condition in which I found the weapon in the present case (For cases illustrating this, see Taylor, 3rd Edn., 1883, pp. 67 and 519, the Saville case, the Gardner case, also Tidy, Part I. pp. 121 *et seq.*).

IV.—Death almost instantaneous. This naturally follows from the

the cause of death. So far as the appearance merely of an incised wound is concerned, Taylor and Aston Key found that one inflicted within two or three minutes after death showed considerable resemblance to one inflicted during life. In the present case, however, the extreme retrac-
osis into
inflicted
alone for
the body
being drained of blood, even parts so remote from the wounds as the

approaching the degree found in the present case.

VI.—Absence of cries and of signs of struggle. This was *prima facie* evidence in favour of suicide. This absence can, on the other hand, be accounted for on the supposition that deceased was taken unawares and a disabling wound at once inflicted. There is much other evidence to support the theory that this really occurred. Ecchymosis might reasonably have been absent, even had deceased struggled, if restraint had been applied with the interposition of some soft medium, such as the prisoner's own clothes. If such a medium had been used over head and face, it would probably have been stained with jets of blood. It should be noted that the clothes which the prisoner is believed to have worn at the time of the alleged murder, were not forthcoming for examination. There may have been marks of jets of blood on them. I further

expressed the opinion that even had (say) the face, mouth, hands, etc., been subjected to firm holding or compression, such as would ordinarily have left bruise marks, yet in the case of deceased, the hemorrhage must have been (from the great size and numbers of the vessels divided) so rapid and copious, that it is quite conceivable that no blood would be left to effuse and ecchymose at the region compressed. Deceased was not drugged into helplessness; the stomach was found healthy, empty, and free from anything which could excite suspicion.

POINTS TENDING TO FIX THE CRIME ON THE PRISONER.—1. The period at which death of deceased occurred. 2. Could the wounds have been caused by the razor found in the right hand of deceased? 3. Were the wounds inflicted on the deceased while asleep? 4. *Rigor mortis*, as a test of the time dead.

1. Hour of death of deceased. This point was of the gravest importance to the prisoner, and, as such, the opinion expressed was subjected, by the defence, to prolonged and searching criticism. The following were the facts involved—Deceased had taken a meal of *chupatties*, curry, and rice a little before retiring to rest at 10 P.M. with her husband (the prisoner), she was not again seen alive; prisoner left the house at 4 A.M., deceased was found dead with her throat cut before he returned. This question to be determined was—did death occur during the period 10 P.M. to 4 A.M., during which the prisoner was in her room, or did it occur after his leaving the house? If the murder was not committed before his leaving the house, then the prisoner was not guilty. The degree to which digestion had advanced was the factor employed to determine whether or not death occurred between the hours mentioned. At the *post mortem* examination the stomach was found quite empty, food, thick and fluid, which had recently undergone gastric digestion,

of the meal was known, and the nature of the food taken. The question remained—in how many hours would the gastric digestion of such a meal be completed and the stomach left empty? If this had taken more than six hours (i.e. from 10 P.M. to 4 A.M.), then deceased died

European meal consisting of meat, vegetables, bread, etc. Meat and other highly nitrogenized foods take longer to undergo gastric digestion than such starchy foods as rice, wheat, etc. For a meal of rice and *chupatties*, then, a shorter time must be allowed for gastric digestion. Sleep retards digestion, though it is impossible to express this retardation definitely in hours. Digestion is more active in the young. Deceased was 11 years of age, and was, presumably, asleep during all, or some part of, the time she was in bed, between 10 P.M. and 4 A.M. It will be seen that it was not possible to state, in hours, the exact time occupied in digesting her last meal; so many modifying circumstances, including those above noted, being present. Taking everything into account, I gave the opinion that the period required to bring her last

meal into the condition found on *post mortem* examination would be at the outside, 6 hours—more probably some hours less. Dr. K. McLeod, speaking as medical expert, gave the period as from 3 to 6 hours—nearer the former than latter. The death was thus shown to have occurred before the prisoner left the house—in all probability.

2 Could the razor found in the hand of deceased have been the weapon with which the wounds were inflicted? I held that it could. The question was raised by the defence, in the interest of the prisoner, the razor having been proved to be the property of the prisoner. To have caused the clean-cut, even, upper margin of the first and great incision, the razor must at that time have been sharp edged. The soft tissues in front of spine must necessarily have been divided before the razor could have cut the bone of the spine and have thereby become notched. The edge would, therefore, have remained uninjured during the incision through the tissues of the left side of neck, the part of the razor—the point—which penetrated to the spine may then have become notched on its edge, but the remaining part of the incision through the tissues in front of spine (i.e. on right side of neck) would be made (even as less deep in the which would not have lost its keen the tissues of the first wound, on to

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Earl of Essex (Taylor, 3rd Edn., 1883, Vol. I. p. 519); in discussing which, Taylor does not dispute the fact that the edge of a sharp razor could be notched by wounding the bones of the spine—be merely affirms that deceased could not have himself done this.

3 Was deceased murdered while asleep? There are a number of reasons for thinking so:—(1) The placid appearance of the face was eminently consistent with the taking of life during sleep. (2) The

to fix the death by this means at a period subsequent to the prisoner having left the house, and thus to clear him of the murder. As the

Results Following, or Likely to Follow, the Injury?

The reply to this question must be cautiously given, as the result of injuries, whether disabling, mortal, or otherwise, depends on a variety of circumstances, especially on: (1) the part injured, (2) the nature and extent of injury; (3) the state of health and age of the injured individual.

Where death has not occurred the questions will be:—"Is the wound dangerous to life?" or "Is it likely to leave permanent injury or incapacity?" The former question can be answered from the details already given with reference to the particular part injured. Secondary dangers are, secondary hæmorrhage, tetanus, septicæmia, and erysipelas. The second question is more likely to arise in civil cases claiming compensation for loss of wage-earning capacity than in criminal, where the intent to injure is the chief factor in awarding punishment. This would be answered on general principles. The question of whether nervous shock is temporary or permanent is the most difficult to answer. '*Grievous hurt*' may sometimes follow, secondarily, as an indirect consequence of an injury, when inflammatory action leads to a stiff joint, loss of hearing, etc., etc.

Where death has followed the injury, it is necessary to satisfy yourself that all the organs are healthy before you can ascribe the death entirely to the wound or other injury.

Causes of Death, etc., in Wounds and Mortal Injuries.

Some injuries causing death may be called "conditionally mortal" injuries, i.e. such as cause death owing to either (1) Disease or infirmity, under which the injured individual labours, e.g. an enlarged spleen; or (2) The supervention of disease, e.g. tetanus, septicæmia, erysipelas; or (3) Want of resort to proper remedies or treatment, as when death occurs owing to loss of blood from a wounded artery of moderate size, such as the brachial. Others may be called '*mortal*' injuries, or injuries intrinsically sufficient to cause death, irrespective of the existence of any conditions such as those above mentioned.

Death from a mortal injury may occur by: (1) Coma, e.g. from pressure on the brain of fragments of bone or effused blood; (2) Asphyxia, e.g. from paralysis of the movements of respiration, or mechanical interference with this process; (3) Syncope from loss of blood, or from mechanical impediment to the heart's action; or (4) Shock, as in death from concussion of the brain, or from the effects of a violent blow over the region of the solar plexus.

In some cases, difficulty may be experienced in tracing the connection between death and an injury proved or alleged to have been received; thus, in the case of injuries alleged to have been caused by the action of external violence on a diseased organ, it may be difficult to determine whether the injury to the organ in question was or was not the result of external violence. In cases of this class, much will depend on (a) the liability or otherwise of the affected part to rupture from causes other than externally applied violence (see 'Rupture of the Spleen,' 'Injuries to the Brain,' etc.), and (b) the presence or absence of marks of violence on the surface of the body over the injured part, or in the tissues situated between it and the surface of the body.

Case—Assault not homicide in rupture of enlarged spleen.—Reg. v. Bysagoo Noshyo—Accused quarrelled with his wife and gave her a kick, which ruptured her spleen. He repented immediately and was found with the woman in his arms helping her. Acquitted under ss. 320 and 322 of Penal Code, but found guilty under ss. 319 and 321. Sentence One year's rigorous imprisonment.—8 W R., Cr. 27.

Case.—Reg. v. Robert Bruce.—Accused was tried for 'causing hurt'

June, 1868.

When ..	to have
caused death	may in
some cases	; disease
is really to be attributed to the injury.	

death, this is such a killing as constitutes murder." Disease of the spleen, however, is not even a disease which need necessarily prove fatal.

Mortal injuries causing death by coma, asphyxia, or hemorrhage leading directly or indirectly to syncope, are not likely to present difficulties of the kind just alluded to. In some cases, however, of death from shock, it is possible that it may be very difficult to trace the connection between death and the alleged violence. With reference to this, it may be pointed out that death from shock may occur: (1) without any mark

of violence being present—this has been often observed in cases where the fatal shock has been due to a violent blow over the region of the solar plexus; or (2) a single slight bruise only may be present as in many reported cases of fatal concussion of the brain, or (3), as often occurs in cases where persons have been severely beaten, from the combined effect of a number of slight injuries, each by itself totally insufficient to account for death. In cases such as these, it is especially important that the *post mortem* examination should be complete, as much may depend on the medical officer being able to state (if it be so) that no appearances were present indicative of a cause of death, other than the alleged violence

Examination of Stained Articles, Blood-Stains, Seminal, and other Stains.

Stained weapons, clothes, bits of furniture, plaster, mud, etc., may be sent for examination in cases of alleged wounds, rape, and unnatural crime. These stained articles are usually passed on by civil surgeons, for want of the requisite apparatus and test materials, to the chemical examiner for his expert report. In sending such articles the same strict precautions as to labelling, sealing, etc., must be taken as in poisoning-cases (*q.v.*).

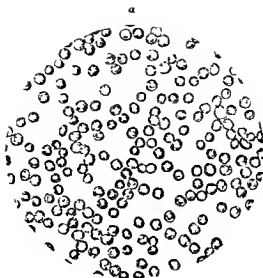
PRELIMINARY EXAMINATION OF STAINS.

1. Note down carefully an exact description of the stained articles, weapons, etc., submitted to you for examination, to enable you afterwards to identify the articles, as the whole case may break down if you cannot identify in court the article from which you have examined the stain. Note the number, shape, size, colour, consistency of stains, on what part of weapon and on which side of the garment, the inside or outside; and if more

2. Cut out part of the suspected stain from the article, and divide each part into at least three portions for tests and control purposes, and carefully preserve as much as possible of the original stain for exhibit afterwards in court.

Authority to cut out portions of the exhibits must be first obtained from the magistrate of the place whence the stain is received.—See Form in Appendix IV.

These stains may consist of (1) blood (see p. 171). (2) semen (p. 297), or (3) other matter; such as hair substance, which may be detected microscopically by its anatomical structure.



a.—HUMAN BLOOD CORPUSCLES $\times 400$.

b.—AMPHIBIAN BLOOD CORPUSCLES $\times 500$.

(From Micro-Photographs by W. H. Gibbs.)

CHAPTER VI.

BLOOD-STAINS.

[By LT.-COL. W. D. SUTHERLAND, M.D., I.M.S.]

Appearance.—When a blood-stain comes to be examined, its blackish through reddish-brown . . . the colour of freshly-shed blood, The colour of the stain depends greatly upon the exposure to light and air that it has undergone. In some cases the efforts of the accused person to get rid of the evidence of his guilt may leave very little trace of the presence of what had been a large blood-stain.

On a hard surface, such as glass or iron, the stain may resemble dark-red wax in parts. If it be the blood of a bird that has caused the stain, the waxy appearance is uniform and highly characteristic. On earth, or plaster, the stain will be dull of surface and dark-brown or greyish-brown in colour.

If the stained fabric be dark in colour, the stains may be hard to detect when examined by daylight. In such a case it is of service to examine the fabric through an eosin-film, as suggested by Popp, or by artificial light, candle-light being the most satisfactory, I think, the rays being allowed to fall obliquely on the fabric.

Often bamboo staves are sent by the Courts for examination, as to the origin of suspicious-looking stains on them. Though the bamboo staff is a very favourite weapon of offence in India, yet it is in only a few cases that the stains on it are found to be due to blood. As a rule they are due to the saliva ejected during the process of betel-chewing, and mimic the appearance of true blood-stains very well indeed; but on further examination of the stain under the microscope their origin is easily enough detected.

I would insist upon the rare occurrence of blood-stains on bamboo staves, although, as we all know, lacerated wounds of the scalp, which at first sight are not unlike cuts made with a

sharp instrument, are common results of blows delivered by means of a bamboo staff.

On the blade of a knife, hatchet, or sword we may often find that what the police have suspected to be blood-stains are really due to rust. On a well-kept knife blood-stains are rarely to be found: in one case a sacrificial knife was sent for examination, but the most careful search failed to detect blood on it, although its surface was chiefly occupied by tracery, doubtless symbolic, and the knife had been in constant use for a long time. The blood, if any be present, will generally be found at the junction of the blade with the handle of the knife, or—in the case of a pocket-knife—in the nick in the blade by which it may be raised by the thumb-nail.

Examination of stain.—In order to be in a position to determine whether a suspected blood-stain is really due to blood, we require—(1) a clean sharp knife; (2) a pair of scissors; (3) some 10 per cent solution of potassium cyanide; (4) some yellow sulphide of ammonium solution;¹ (5) a microscope with a $\frac{1}{2}$ inch, a $\frac{1}{6}$ inch, and a $\frac{1}{12}$ inch oil immersion lens; (6) a Zeiss' modification of Browning's pocket-spectroscope, with—this is indispensable—a wave-length scale.

If the stain be on a hard surface, a portion of it may be moistened with the potassium cyanide solution, scraped off and smeared on a microscopic slide. If it be a soft fabric that is stained, a portion of the stain may be snipped off, immersed in boiling water for three seconds to fix the colouring matter by coagulation, placed on the microscope slide and treated with a drop or two of the potassium cyanide solution, the superfluous fluid being removed at each stage of the process.

To the stains thus treated, there are then applied a few drops of ammonium sulphide solution. The preparation is then covered with a cover-glass, the superfluous fluid is mopped up by a fresh morsel of bibulous paper, and the preparation examined under a low power. If blood be present, at some spot in the preparation we shall see a cherry-red colour. If the coloured part be very small, we bring it into focus under a high power, and then, having removed the eye-piece, insert into the microscope-tube the long tube of the spectroscope. The absorption band or bands visible in the spectrum may now be fixed as to their position on the scale by the simple device of holding a piece of white paper below the end of the short tube of the spectroscope, to illuminate the scale well.

¹ Saturate a 1 : 4 solution of ammonia with hydrogen sulphide and then add an equal volume of ammonia solution, the resultant being $(\text{NH}_4)_2\text{S}$ in solution, which must be kept in a stoppered bottle.

If blood pigment be present, it will have been converted into **cyanhaemochromogen**, whose spectrum gives a dark band at $\lambda 570-550$ and a darkish band at $\lambda 540-525$, the latter,

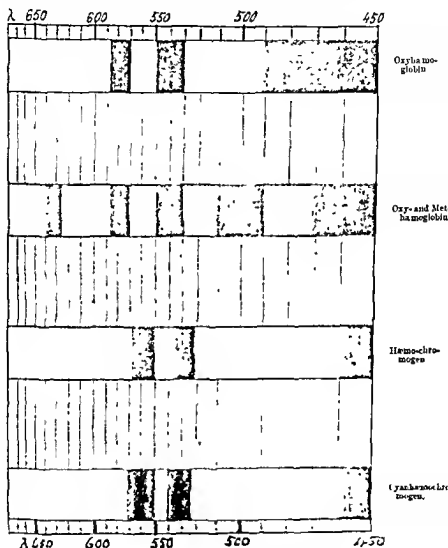


FIG. 13.—The Four useful Spectra of Blood-pigment.

however, if the dilution be high, may be so faint as to be almost or quite invisible.

No other known substance when treated as above described

sharp instrument, are common results of blows delivered *by means of a bamboo staff*.

On the blade of a knife, hatchet, or sword we may often find that what the police have suspected to be blood-stains are really due to rust. On a well-kept knife blood-stains rarely to be found: in one case a sacrificial knife was sent for examination, but the most careful search failed to detect blood on it, although its surface was chiefly occupied by traces doubtless symbolic, and the knife had been in constant use a long time. The blood, if any be present, will generally be found at the junction of the blade with the handle of the knife—or—in the case of a pocket-knife—in the nick in the blade which it may be raised by the thumb-nail.

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If the stain be on a hard surface, a portion of it may be moistened with the potassium cyanide solution, scraped off, and smeared on a microscopic slide. If it be a soft fabric that is stained, a portion of the stain may be snipped off, immersed in boiling water for three seconds to fix the colouring matter by coagulation, placed on the microscope slide and treated with a drop or two of the potassium cyanide solution, the superfluous fluid being removed at each stage of the process.

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¹ Saturate a 1 : 4 solution of ammonia with hydrogen sulphide and add an equal volume of ammonia solution, the resultant being $(\text{NH}_4)_2\text{S}$ solution, which must be kept in a stoppered bottle.

If blood pigment be present, it will have been converted into **cyanhaemochromogen**, whose spectrum gives a dark band at $\lambda 570-530$ and a darkish band at $\lambda 540-525$, the latter,

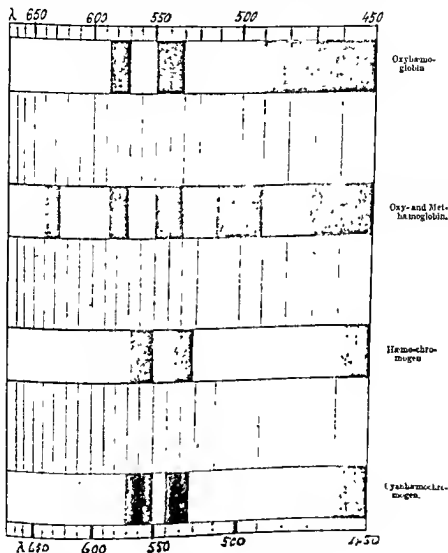


FIG. 13 —The Four useful Spectra of Blood pigment.

may be so faint as to be
treated as above described

gives the cherry-red colour *and* the spectrum of cyanhæmochromogen. Hence the value of this method of examination, whose technique has been elaborated by Hankin. The test is a most delicate one and should always be employed. Thus carried out the use of a microspectroscope is obviated, and this is a great advantage, as all who have ever used one will agree. If, as sometimes happens, we have a large stain or a quantity of earth available for the test, then it may be simplified by extracting a considerable portion of the stain with physiological salt solution, and adding to the contents of the test-tube a few drops of pyridin, when the brownish liquid will become cherry-red, and then a few drops of the ammonium sulphide solution. The contents of the test-tube are then examined by the long arm of the spectroscope being held against the tube, and the spectrum of hæmochromogen, which is slightly different from that of cyanhæmochromogen, will be seen, if blood is present.

Were the blood-stains quite fresh—a rare event in Indian forensic medical practice—we should find it hard to get rid of the characteristic spectrum of oxyhæmoglobin: two bands, one at $\lambda 587-570$ and the other at $\lambda 550-530$. But in most cases the stains are old enough to yield, on extraction with distilled water or physiological salt solution, the spectrum of oxy- and met-hæmoglobin: four bands, one at $\lambda 640-628$ in the red, one at $\lambda 587-570$, one at $\lambda 550-530$, and the fourth, which is generally merged in the absorption of the blue rays, at $\lambda 510-490$. Of these spectra the figures are given (Fig. 13)—special attention being directed to the actual position of the absorption bands in the wave-length scale, for it is their position which is all-important.

In my opinion it is sheer waste of time to attempt to obtain the other spectra of blood. The spectra of acid and alkaline bæmatin are the reverse of delicate, and I do not know of any case in which it has been necessary to obtain the spectrum of hæmatoporphyrin here in India, although in a few cases in Europe it has been of use.

Teichmann's crystals.—We may obtain in many cases valuable confirmation—or rather corroboration of our spectroscopic findings by treating a fragment of the stain thus:—On a clean microscope slide a drop of salt solution is evaporated. Near the spot thus formed is placed a minute fragment of the stain. On to the preparation is dropped a drop of glacial acetic acid. The preparation is then covered and warmed in the Bunsen or spirit flame until bubbles appear. It is then laid aside and examined after half an hour. Under the low power of the microscope we shall find a multitude of dark specks, which under the high power will be found to be the various

forms of the crystals of hæmatin chloride. Of these an excellent representation is given in the illustration, which I owe to Major W. H. Dickinson, I M.S., who drew the illustration from a specimen made in actual practice. The slower the generation of the crystals the more numerous will be their ultimate form—the rhombs, and the larger these will be.

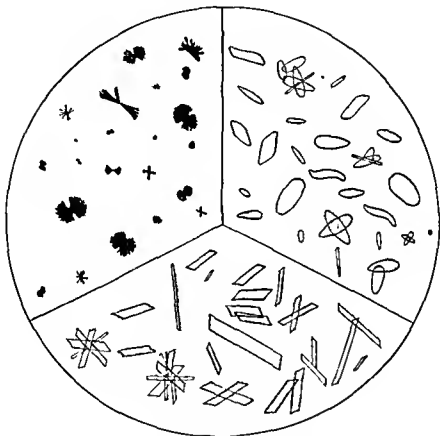


FIG 14.—Hæmatin Chloride Crystals.

(Drawn by Major W. H. Dickinson, I M.S., from a specimen obtained in actual practice.)

The preparation must be only gently heated, and the acid must be glacial. But even when these conditions are fulfilled and blood is really present we may fail to obtain the crystals owing to changes having been brought about in the blood by exposure or rust, or both.

As crystals like those of hæmatin chloride may be obtained

from indigo-dyed fabrics, it is well to remember that the crystals of hæmatin chloride will cause frothing of a drop of hydrogen peroxide, whereas the others will not, as was first pointed out by Glaister.

Guaiac test.—I mention another test, not because I use it—my reasons for rejecting it have been detailed elsewhere—but because it was highly praised by Taylor, whose monumental work is looked upon with great reverence by the Bar in India, and it is likely that the medical witness might be asked if he had applied this test, which was discovered by van Deen. All who now use it, with the sole exception of Mita,¹ do not do more than rely on it as a negative test: if they do not obtain the characteristic blue, they conclude that blood is not present. If they do obtain the blue, they do *not* look upon this fact as irrefragable proof that blood is present.

A good way of performing the test is this—a portion of the stain is moistened with distilled water, and then has pressed down on it, with gentle rubbing, a piece of moist white filter-paper. To the brownish stain acquired by the filter-paper are applied (1) a drop of a freshly-prepared straw-coloured tincture of guaiac resin, and then (2) a drop of old oil of turpentine, or hydrogen peroxide. Mita states that if he obtains on adding the guaiac a cherry-red colour, which turns to dark blue within half a minute of the addition of the oil of turpentine, he has satisfactory evidence of the presence of blood. In this opinion he appears, as I have said, to be in a minority of one.

Since the hæmochromogen test is so delicate as to be more useful even as a negative test than the Guaiac test, to perform the latter appears to be a waste of time.

Microscopic examination.—Having arrived at the conclusion that the stain before us is really due to blood, we proceed to determine whether this has come from a mammal or a non-mammal thus:—A minute fragment of the stain is left to soak in two drops of Vibert's fluid— $\frac{1}{2}$ gramme mercuric chloride and 2 grammes of common salt in 100 c.c. of distilled water—for half an hour. It is then teased out and examined. Under the low power one of the yellowish-red masses, due to agglomeration of erythrocytes, is brought into the centre of the field. The more or less amorphous debris, and the fibres of the material stained do not interest us. Under the high power the mass will reveal the erythrocytes, of which it is composed, and at its periphery the general shape of these can usually be fixed, as also the presence or absence of nuclei. Near the edge

¹ Gross' *Archiv* 1909, 35, 361.

of the mass may often be found a group of four or five erythrocytes, and with luck one may find a solitary erythrocyte.

If bird's or fish's blood be present we shall rarely find the erythrocytes entire. In the great majority of cases all that we shall see will be a mass of granular elliptical nuclei. These must be carefully examined in order to determine that they are nuclei and not misshapen circular erythrocytes that have undergone granular degeneration. If we find elliptical erythrocytes with elliptical nuclei the diagnosis of non-mammalian blood is very easy; but such cases are unfortunately not common.

If mammalian blood be present we shall find circular erythrocytes more or less altered in shape, and perhaps granular. But nuclei will be very rarely present, for it is only very few *very young* mammalian erythrocytes that are nucleated, and it is very rarely that one of these is seen amidst the thousands of non-nucleated corpuscles that are found in a single preparation. The erythrocytes of the camel are olliptical, and *might* be mistaken for the nuclei of non-mammalian erythrocytes; but here the biochemical test would clear up the difficulty, if any.

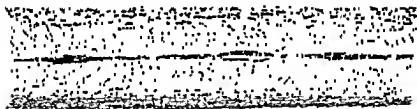


FIG. 15.—Human Hair.

(By W. H. Dickinson.)

Light brown hair from head. The darker the hair, the greater the amount of pigment, and the less structure seen.

Only practice will enable the observer to come to a decision after examining one or two blood-masses under the oil-immersion lens. The beautifully marked differences seen in fresh preparations of mammalian and non-mammalian blood are not present in preparations made from old blood-stains.

I do not think that one gains much by using a micrometer—stage- or eye-piece. It is not the size of the erythrocytes seen that matters so much as their general shape and the presence or absence of nuclei. It is quite useless to attempt to determine by means of micrometry, the origin of mammalian erythrocytes. Even in the case of fresh blood the determination is not sufficiently accurate to be of much use in forensic

medicine The coefficient of drying of erythrocytes has not yet been, nor is it likely to be, determined, still less the degree of return to their original size as the result of treatment with any of the various fluids that have been devised for treating preparations of blood-stains. Thus we can never be certain that the erythrocytes from a stain have regained their exact size when fresh, neither more nor less. Reference to any table—or to my monograph—will show that even in the case of fresh blood the erythrocytes of various species of mammals differ very little from those of man, and that this is true only of average specimens the individual specimens of any one species

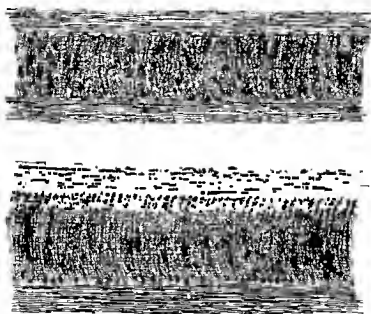


FIG. 16.—Cat's Hair
(By W. H. Dickinson)

may differ more in size from each other than the average specimens of that species from the average specimens of another species.

At the end of this chapter I have collected a few cases, which illustrate the aid given by the microscope in Indian forensic medicine.

In some cases we shall find hairs in the stain, and these may be of service to us. The determination of the source of a hair is not easy, but Major Dickinson, who has made a special study of hairs, has kindly drawn several from nature.

Micro-photography would not have brought out the characteristics of each type so clearly as do these admirable drawings, for which I am deeply indebted to him

Biochemical tests.—These are of recent growth, but are none the less trustworthy, and by them we are enabled to determine the origin of a blood-stain with accuracy.

The Precipitin test can always be carried out here in Calcutta in a well-equipped laboratory by a skilled observer. In order to understand it we must remember that the living organism has the power of manufacturing antibodies for any albuminous material that may be introduced into it. These antibodies exist in the blood of the animal that has been treated, and the blood or its watery portion—the serum—can be stored for use. If we take a dilute solution of the albuminous material in question and to this very carefully add a few drops of the serum of the animal that has been treated with it we shall find a reaction take place: at the point of contact of the animal's serum with the albuminous solution there will come into being a cloudy layer. This is due to the precipitation of the albuminous particles by the precipitins contained in the treated animal's serum. The reaction will not occur if the serum be added to a solution of an albuminous material other than that with which the animal was treated. In other words, the reaction is a specific one. It is also a very delicate one, for even if the solution of albuminous material be of only one part in a thousand it will readily become evident.

For forensic medical practice the observer must have at hand the serum of animals—fowls are as good as any—that have been treated each with the blood of one of the domestic animals—dog, cat, horse, buffalo, pig—and a large quantity of the serum of fowls treated with the blood of man. For the question which he will have to answer is: Is this stain due to human blood?

From the domestic animals the blood is obtained by venesection; in the case of man it is most conveniently obtained from the placenta, after the umbilical cord has been cut. The blood is collected with great care, to avoid all chance of contamination, and kept in sterile flasks in which it is allowed to clot. As the clot shrinks the serum exudes, and next day this is decanted and heated to 56° C. for half an hour. It is then stored in sterile phials, corked and sealed with paraffin, which are kept in the freezing chamber until they are needed.

The fowl's wing is carefully purified on the inner surface by being swabbed with pledgets of cotton-wool soaked in ether—and then the serum (thawed and brought up to 37° C. or

a little higher) is injected into the wing vein. The dose is usually 4 c.c. On the fourth day a second injection is made, the other wing being used. Fourteen days after the second injection the fowl is bled. Its blood is collected as above

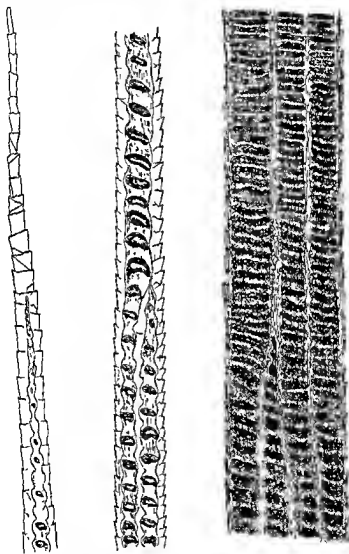


FIG 17.—Rabbit's Hair
(By W. H. Dickinson.)

described, and next day the serum is tested as to its precipitating power and specific action thus:—

The sera of the domestic animals and of man are diluted

a thousandfold with physiological salt solution. In a stand are placed six taper tubes—and into these are put the 1:1000 dilutions of serum, the last tube receiving only salt solution. Then each tube has its contents allowed to run nearly out of it, to wet its inner surface well. It is then held in a slanting position, and down its side are allowed to run two drops of the treated fowl's serum—which may conveniently be called the antiserum.

Supposing that the fowl had been treated with human serum, then if the antiserum derived from it be specific and highly potent we shall within three minutes observe a marked reaction in the tube containing the 1:1000 dilution of human serum, but in no other tube will any reaction be visible even after the lapse of twenty minutes. This antiserum is stored for use, and every time that it is used for testing blood-stains its specificity and high potency are tested again, in the way above described, so that the observer may be sure at the time of testing the blood-stains that his antiserum fulfils the desiderata of the forensic test: for sometimes potency and specificity become altered by keeping. The accompanying plate shows the reaction in one tube and its absence in all the others.

The number of treated fowls that yield a good antiserum is fairly large—over 50 per cent. Many are refractory, and many yield a serum that is weak, and therefore useless for medico-legal work.

When the observer desires to determine the origin of a blood-stain he makes an extract of it, by soaking the stained fabric or scrapings of the stain in physiological salt solution. Some stains are hard to extract, and for these the addition of a few drops of solution of potassium cyanide to the salt solution in which they are immersed is a good plan. The stain extract is then tested as to its alkalinity or acidity. If it be acid it must be rendered neutral or slightly alkaline by the addition of a drop or two of a weak solution of caustic soda, or potassium cyanide. If it be strongly alkaline, as it will be if the cyanide solution has been used to hasten extraction, it must be rendered only slightly alkaline by the addition of a drop or two of a solution of tartaric acid.

The extract having been thus treated is diluted with salt solution until it corresponds to a 1:1000 dilution of serum. The guide is the amount and persistence of the froth formed on gentle shaking. A little practice enables the observer to obtain the necessary dilution of the extract with surprising accuracy. The dilution is carried out in order that the test may be as delicate as possible. If anti-human serum be added

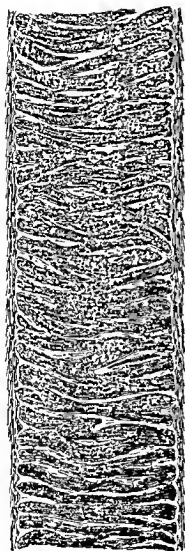


FIG. 18.—Guinea-pig's Hair.

(By W. H. Dickinson.)

to, say, pure horse serum or a 10-fold dilution thereof we shall have a reaction—the mammalian reaction, as Nuttall first

called it—but if the horse serum be diluted to 1 : 500 no such reaction will occur within 20 minutes—and it is still less likely to occur if the dilution be 1 : 1000.

Dilute, water-clear¹ extracts of all the stains that have been proved to be due to blood having been made, these are set out in taper-tubes. To the contents of each tube the observer adds two drops of an anti-human serum, which he has already tested on the morning of that day, and found to be highly-potent and specific in reaction. When testing it, he has guarded against too rapid thawing, which interferes very much with the specificity of reaction, for the physical attributes of the serum are obtained in their entirety only by very slow thawing. The tubes whose contents show reaction within twenty minutes are noted. The stains whose extracts are in these tubes are proved to be due to human blood. *Monkey's* blood has been only once alleged to have caused the stains found on articles examined by me; but, as I have shown elsewhere,² even those apes that are most nearly related to man are sufficiently far removed from man for their blood to be differentiated from his by the 20 minutes' time-limit of the reaction. Other portions of the extracts which have shown no reaction with the anti-human serum are now tested with an anti-ruminant serum. Should any stain-extract still show no reaction, a fresh portion of it is tested with anti-canine, anti-equine, etc., serum until the whole gamut of the domestic animals has been gone through. Of course, should the police have reported that it is suspected that the blood of, say, a cat has been smeared on the articles sent for examination, the anti-feline serum is the first that is used after the anti-human serum. I may note that in those cases in which the police had reason to suspect that what was alleged to be human blood had an origin other than human, their suspicion was generally found to be well-grounded. The wiles of those who desire to get their enemies punished, or to escape from the consequences of their own acts, are many, but the police seem to be quite able to cope with them. From the large amount of material that has passed through my hands, I am convinced that the work of the police in grave criminal cases is far more honest than certain of the lower organs of the press here care to admit. Why I am so convinced will be clear to all unprejudiced readers of the details of the examination of articles given below.

¹ The extracts will not be quite clear in the case of blood-stained clothes, and in some cases the dilution is much higher than 1 : 1000, because the quantity of albuminous material in the stain is so minute.

² DUTHELLAND, "The Application to Medical Practice in India of the Biochemical Tests for the Origin of Blood-stains" Calcutta, 1910. (*Scientific Services*, New Series, No 23)

If a blood-stain has been washed it will usually be impossible to say more than that it is due to mammalian or non-mammalian blood. If it has been well washed all that can be

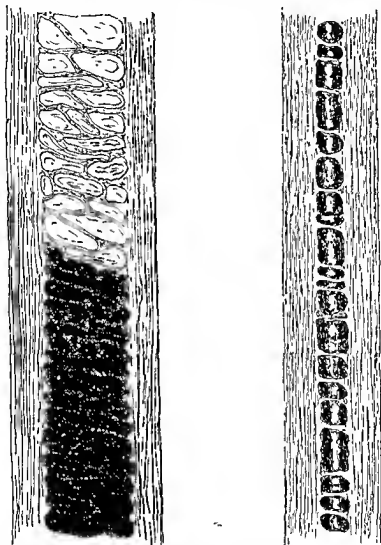


FIG. 19 —Dog's Hair; Irish Terrier.
(By W. H. Dickinson)

said is that it is due to blood, whose elements are too disintegrated for its source to be determined. Failure to obtain a reaction with the extract of a blood-stain may be due to any of the following causes: (a) The extract when diluted to the

1:1000 standard may be incapable of reacting with the anti-serum, owing to the paucity of albuminous material that is present. Such a result *may* occur in the case of microscopically visible stains; but, in my experience, does not occur where the stain is plainly visible to the naked eye, and has not been interfered with by any of the substances noted hereunder. (b) The extract, if markedly acid, will not react until it has been rendered nearly neutral. (c) If mercuric chloride be present, one part in 10,000, or permanganate of potassium be present in even smaller amount, the reaction will not occur. (d) Chloride of lime, sulphate of copper, sulphate of iron, chloride of zinc and bisulphide of sodium have all an adverse influence on the reaction. Fortunately none of these compounds is commonly met with in forensic medical practice here; but the observer must bear in mind that any of them may be present, and interfere with the reaction. Naturally, if a stain-extract, that froths when diluted to 1:1000, and is neutral

serum,

be due .

any of .

with, say, anti-ovine serum, showing thereby that the physical characters of its elements have not been interfered with; or *vice versa*. Putrefaction of the stains does not influence the reaction. This is fortunate, for sometimes blood-soaked garments are so carelessly packed that, before it dries, the blood undergoes a marked change. The age of the stain does not matter. I have obtained the characteristic reaction from extracts of stains that had lain in Calcutta for over four years, and it is not likely that stains of greater age than this would fail to be examined.

Here in India one is frequently called upon to examine earth that has been dug up from the floor of a dwelling, or from a courtyard, or a field, with a view to ascertain whether the stains on it are due to human blood. Having determined that blood is present, the observer might be at a loss to discover its source, owing to the fact that his best endeavours to obtain a clear extract fail miserably. The diluted extract remains turbid on account of the particles of clay or humus that remain in suspension, in spite of repeated filtration and centrifugalization.

With such an extract the test, if carried out in the ordinary way by daylight—by inspection of the contents of the tube against a black background against the light—reveals nothing: the turbidity masks the layer of reaction, if it exists. This difficulty may, I find, be surmounted by a very

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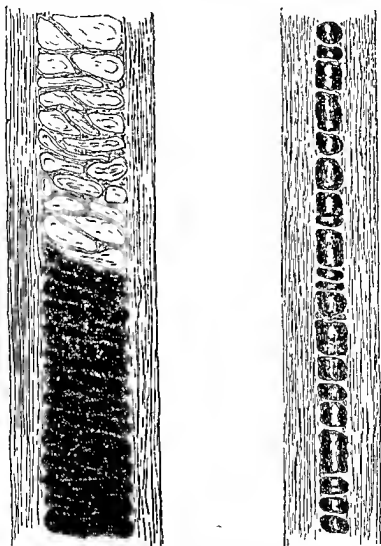


FIG. 19.—Dog's Hair; Irish Terrier.
(By W. H. Dickinson)

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With such an extract the test, if carried out in the ordinary way by daylight—by inspection of the contents of the tube against a black background against the light—reveals nothing: the turbidity masks the layer of reaction, if it exists. This difficulty may, I find, be surmounted by a very easy manœuvre.

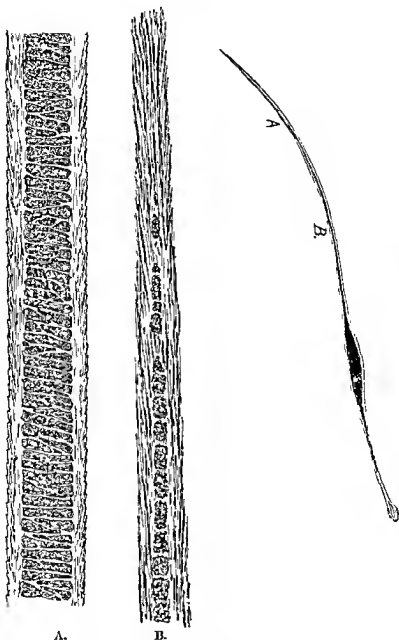


FIG. 20.—Indian Ox Hair.
(By W. H. Dickenson.)

Instead of viewing the tube-contents against the light, they should be viewed against the black background held nearly at

right angles to the light. When so viewed the turbidity of the extract-dilution, which was so marked when this was viewed against the light, will be found to have disappeared, while the layer of reaction, if present, remains clearly visible.

If we add anti-goat serum to dilute extracts of stains caused by ox, buffalo, goat or sheep bloods, all will react in a greater or less degree: for the ruminants are very closely akin. In order to determine which ruminant is the source of the blood in any case, we must test separate portions of the stain-extract with anti-goat, anti-sheep, anti-ox, and anti-buffalo sera. The anti-serum which gives the greatest and most rapid reaction will guide us in such a case.

The use of fowls as the source of the various precipitating anti-sera is of great service in India, where rabbits, which are commonly used in Europe, are hard to obtain. The fowls must be carefully isolated for ten days after purchase to exclude those infected with *pasteurella*. Here in Calcutta the Chittagong breed of fowls is to be preferred, as the birds are much larger than those obtainable in Northern India.

The complement-fixation test.—Although this test cannot be carried out satisfactorily in India,¹ it merits mention, which will be as brief as is consistent with intelligibility. The test is based upon the fact that when an animal receives injections of the washed erythrocytes of another species, its serum in time develops the power of causing the erythrocytes of that other species to become rapidly dissolved if they are brought into contact with the serum in a test-tube.

If we treat a rabbit by means of injections of washed sheep's erythrocytes, made into the ear-vein, and repeated twice at three days' intervals, its serum, if taken on the fourteenth day after the last injection, will be found rapidly to dissolve sheep's erythrocytes but not the erythrocytes of other animals. This treated rabbit's serum contains two elements that are of importance: (1) the complement, and (2) the antibody for sheep's

, the complement
or the antibody is
complement.

Thus if we put into a test-tube some fresh guinea-pig's serum (complement), some heated serum of a treated rabbit

¹ Professor Powell writes. "I have carried out the complement-fixation test satisfactorily in India. It is eminently satisfactory and extraordinarily accurate. Its only drawback is the expense of keeping up the animals."

(antibody) and some sheep's erythrocytes in suspension in physiological salt solution, the dissolution of the erythrocytes will be speedily brought about, their pigment passing out into the fluid.

If we take complement and incubate it for an hour at blood-heat with an extract of a blood-stain, and then add to the contents of the tube the antibody and the sheep's erythrocyte-suspension, we shall have dissolution of the erythrocytes as before. But if we take complement, and the blood-stain extract, *and some antiserum for the blood that caused the stain*, on incubating these we shall have the antiserum combining with the albuminous elements of the extract. This combination has the property of *fixing the complement, so that none is left over to act in concert* with the antibody of the treated rabbit's serum when this is added, and consequently when the erythrocytes are added they are not dissolved.

Thus we see that if we have incubated together for an hour (1) complement with (2) the extract of a blood-stain and (3) some anti-human serum and then on adding (4) some heated serum of a rabbit that has been treated with sheep's erythrocytes, and (5) a suspension of sheep's erythrocytes, we obtain dissolution of the erythrocytes, we may be sure that no combination of the albuminous elements of the stain-extract with the anti-human serum has taken place. In other words, we have proof that the stain is not of human blood. If dissolution of the erythrocytes does not occur, this shows that the complement had become fixed before the antibody was added, i.e. that the anti-human serum had combined with the elements of the stain-extract, because these are of human origin.

In actual practice the treated rabbit's serum after it has been heated has its power of causing the complete dissolution of 1 c.c. of a 5 per cent suspension of sheep's erythrocytes in physiological solution estimated: the smallest quantity of the serum that is required for this is noted, and holds good so long as the supply of that particular rabbit's serum lasts. The smallest quantity of the anti-human serum—or anti-equine, etc., serum—which will cause fixation of the complement in the presence of 100000 c.c. of human serum (or equine, etc., serum as the case may be) is determined, and holds good so long as the supply of that particular anti-serum lasts. The requisite amount of the complement must be ascertained on the morning of the day when the test is carried out.

Altogether a tedious task, which, even after all requisite quantities have been determined, takes at least four hours to perform. Another drawback is the fact that many materials which may have blood-stains on them have, when extracted, an

anti-complementary action. This is not removed by boiling, whereas the specific action of the stain-extract is destroyed by boiling. Therefore two series of tubes are needed. In one series are put boiled, in the other unboiled, extracts of the stained materials, and into all are put the necessary elements of the test, the results obtained in the two series being then compared.

Here in India the great difficulty in the way of the observer is the fact that it is exceedingly hard to obtain the very strong anti-serum required to cause complement-fixation in the presence of the minute amount of albuminous material in the very high dilution of the stain extract that is used in practice. The higher the dilution the more delicate the test, because the more specific, and thus the more trustworthy the results obtained by it.

One consolation is that even were one able to carry out the test here as it is performed in Europe, its results would be only corroborative, and not in any way corrective, of those obtained by means of the precipitin test.

The anaphylaxis test.—This test I have not yet had occasion to employ, but describe it, as it may later be found possible to have recourse to it in those cases in which the results obtained by means of the precipitin test seem to call for corroboration.

It is based upon the fact that when an animal—preferably the guinea-pig, which is very sensitive—receives an injection into its circulation or under its skin of some foreign albumin it develops extraordinary hypersensitiveness to this albumin, so much so that if the first injection be of $\frac{1}{100}$ c.c. of sheep's serum, and the second dose be $\frac{1}{2000000}$ c.c. the body temperature will rise and continue to rise for about an hour, whereas a previously untreated guinea-pig requires $\frac{1}{20}$ c.c. of sheep's serum in order that its body temperature may rise as shown by Friedberger.

The shock caused by larger doses of foreign albumin is

only $\frac{1}{1000000}$ c.c. given intraperitoneally.

The hypersensitiveness comes into being only after a certain time has elapsed since the first dose of sensitizing albumin was given. Conveniently the fourteenth day may be taken for the second dose in medico-legal work, the test being carried out thus:—

A series of guinea-pigs—say six—is treated by means of injections of $\frac{1}{100}$ c.c. of human, bovine, feline, equine, etc., serum given intraperitoneally or subcutaneously. On the fourteenth day this series is ready for the test. An extract of the suspected stain is then made with physiological salt solution. The guinea-pigs' body temperature is taken, by a special thermometer being introduced into the rectum, and noted. Then each animal receives an intraperitoneal injection of a portion of the stain extract, which has been divided into seven parts. The seventh part is given to an untreated guinea-pig, which acts as a further control.

Now, supposing that our stain is due to human blood we shall have—

	Result
1. G P. sensitized with horse serum . . .	nil.
2. " " " sheep serum . . .	"
3. " " " dog serum . . .	"
4. " " " cat serum . . .	"
5. " " " pig serum . . .	"
6. " " " human serum . . .	body temperature shows marked change.
7. " not previously treated . . .	nil.

The change in the body temperature will depend on the quantity of human albumin that was given by the second injection. If this was but small the temperature will show a rise; if the quantity was large there will be a distinct fall.

As will be seen, this test is wasteful of guinea-pigs; for the first animal of our series will now be hypersensitive to equine and to human albumin, the second to ovine and human albumin, and so on. Still there might arise a case in which the information afforded by the test would be of value.

DETAILS OF FINDINGS AS TO 13,096 ARTICLES, SUSPECTED TO BE BLOOD-
STAINED, EXAMINED IN 5000 MEDICO LEGAL CASES

Source of blood						
	Total	Blood- stained	Non mam- malian	Mammalian		Not identified as to exact source
				Identified		
				Human	Not human	
Adze	30	14	—	11	—	—
Amulets	2	—	—	—	—	—
Apparel, wearing	6340	5203	26	4526	1 ruminant 51 sheep or goat 31 ox or buffalo 5 sheep and human 1 goat and human 2 ox and human 1 camel 1 dog	109
		1 also mammalian.				
Arrow	19	14	—	9	—	1
Ashes	9	5	—	4	—	—
Awl	5	4	—	4	—	—
Axe	409	206	7	153	10 sheep or goat 3 ox or buffalo	11
Bag, haversack	8	6	2	4	—	—
Bamboo	458	276	—	218	6 sheep or goat 2 ox or buffalo 2 sheep or goat	9
Bark	10	7	—	8	—	—
Barrel	2	2	—	2	—	—
Basket	18	12	—	11	—	—
Bayonet	2	1	—	1	—	—
Beads	8	8	—	6	—	—
Bedding	344	268	—	158	1 sheep or goat	2
Belt	3	3	—	3	—	—
Bench	2	1	—	1	—	—
Bill-hook	345	244	2	207	3 ox or buffalo 2 sheep or goat 1 dog 1 canine 1 ox or buffalo 6 sheep or goat	1
Blood	16	16	—	11	—	—
Bone	24	8	—	14	—	—
Book	2	1	—	1	—	—
Bottle	4	2	—	2	—	—
Bracket	1	—	—	—	—	—
Brick, tile	69	52	1	47	1 sheep or goat	—
Broom	5	4	—	4	—	—
Bucket	2	1	—	1	—	—
Can, canister	3	3	—	3	—	—
Cardboard	1	1	—	1	—	—
Cart	8	3	—	1	2 ox or buffalo	—
Celluloid, sheet of	1	1	—	1	—	—
Cement, plaster	53	35	—	27	3 sheep or goat 1 ruminant	—
Chair	1	1	—	1	—	—
of rail	1	1	—	1	—	—
Charcoal	1	—	—	—	—	—

			Source of blood			
	Total	Blood-stained	Non-mammalian	Mammalian		Not identified as to exact source.
				Identified.		
				Human	Not human	
Chisel	13	5	—	5	—	1
Chopper, straw	183	118	—	105	1 ox or buffalo	1
" meat	8	8	—	8	—	—
Cigarettes	2	—	—	—	—	—
Coconut-scraper	1	1	—	1	—	—
Coins	6	5	—	5	—	—
Coir ..	1	1	—	—	1 sheep or goat	—
Convict's neckticket	1	1	—	1	—	—
Cordage ..	68	49	—	42	2 sheep or goat 1 ox or buffalo 1 horse	2
Corrugated iron	1	—	—	—	—	—
Cot ..	21	13	—	9	—	—
Cotton wool ..	9	4	—	4	—	—
Cowdung ..	10	9	—	6	—	—
Crowbar ..	11	6	—	6	—	—
Curtain	3	1	—	1	—	—
Cutter, arecanut	2	2	—	2	—	—
" fish	15	12	—	9	—	—
" grass	3	1	—	1	—	—
" leather	1	1	—	1	—	—
" vegetable	11	8	—	8	—	—
" wire ..	4	3	—	3	—	—
Dagger ..	49	39	—	27	2 sheep or goat	1
" sheath	3	1	—	1	—	—
Dibble ..	4	3	—	3	—	—
Door-panel ..	6	3	—	3	—	—
" framo ..	1	—	—	—	—	—
Earth ..	1146	831	14	691	20 sheep or goat 8 ox or buffalo 2 cat 1 dog 1 pig	19
Fan	1	1	—	1	—	—
Fæces of tiger (supposed)	1	—	—	—	—	—
Feather ..	2	2	—	1	—	—
Fibre, aloo ..	1	—	—	—	—	—
File	2	1	—	1	—	—
Flesh	12	—	—	7	1 ox or buffalo 1 goat 1 horse	—
Flesh, cooked ..	2	—	—	—	1 ox or buffalo	—
Fluid (suspected to be blood-stained)	3	3	—	3	—	—
Fork	1	—	—	—	—	—
Fruit	2	1	—	1	—	—
Glass, pane ..	4	4	—	4	—	—
Gourd	1	—	—	—	—	—
Hair, not adherent to weapon	44	26	—	35	1 insect 1 feline 1 vegetable-fibre	—

Source of blood

Mammalian

	Total	Blood stained	Non-mammalian	Identified		Not identified as to exact source
				Human	Not human	
Hair pin	1	—	—	—	—	—
" tuft of Hindu	1	1	—	1	—	—
Halbert	6	3	—	2	—	—
Hammer, mallet	14	13	—	9	—	—
Harness	9	4	—	3	1 ox or buffalo	—
Hat, cap, turban	197	160	1	145	2 ox or buffalo	1
Hoe	1	1	—	1	—	—
Hook	2	—	—	—	—	—
Implement, farm	6	2	1	1	—	—
" wooden	1	1	—	1	—	—
Iron, bar	5	3	—	3	—	—
" fragment	4	2	—	2	—	—
" hoop	1	—	—	—	—	—
Jewellery	104	83	—	78	—	2
Jute	2	1	—	—	—	—
Key	2	1	—	1	—	—
Kitchen utensils	16	10	—	9	—	—
Knife	316	259	5	197	9 sheep or goat 5 ox or buffalo	11
" sacrificial	6	1	—	1	—	—
Kukri knife, Gurkha	12	5	—	5	—	—
" sheath	2	—	—	—	—	—
Ladder	1	1	—	1	—	—
Lamp, lantern	4	2	—	2	—	—
Lamp-stand	1	1	—	1	—	—
Latch, wooden	2	2	—	2	—	—
Leaves	116	91	2	77	2 sheep or goat	1
1 mammalian and non-mammalian.						
Letter	1	1	—	1	—	—
Lint	1	1	—	1	—	—
Match	2	2	—	2	—	—
" box	3	3	—	3	—	—
Mattings, carpet	134	102	5	88	5 sheep or goat	2
Micro-slide	1	—	—	—	—	—
Nail parings	49	6	—	6	—	—
Nuts	3	3	—	3	—	—
Paper	7	5	—	5	—	—
" currency note	1	—	—	—	—	—
" dispensary ticket	2	2	—	2	—	—
Pencil	1	1	—	1	—	—
Pestle	2	2	—	2	—	—
Pickaxe	7	4	—	2	—	—
Pipe, huqqa	4	4	—	4	—	—
Pistol	2	1	—	1	—	—
Plants, various	37	32	—	30	1 ox or buffalo	1
Plates	1	1	—	1	—	—
Playing cards	4	4	—	4	—	—
Polo stick	1	1	—	1	—	—
Pot, earthen	30	21	—	18	—	1
" brass	12	9	—	8	—	—

	Source of blood.					
	Total	Blood- stained	Non- mam- malian	Mammalian		Not identified as to exact source.
				Identified.		
				Human	Not human.	
Chisel	13	5	—	5	—	1
Chopper, straw	183	118	—	105	1 ox or buffalo	1
" meat	8	8	—	8	—	—
Cigarettes	2	—	—	—	—	—
Coconut-scraper	1	1	—	1	—	—
Coins	6	5	—	5	—	—
Coir	1	1	—	—	1 sheep or goat	—
Convict's neckticket	1	1	—	1	—	—
Cordage ..	68	49	—	42	2 sheep or goat 1 ox or buffalo 1 horse	2
Corrugated iron	1	—	—	—	—	—
Cot	21	12	—	9	—	—
Cotton wool ..	9	4	—	4	—	—
Cowdung	10	9	—	6	—	—
Crowbar	11	6	—	6	—	—
Curtain	3	1	—	1	—	—
Cutter, arecanut	2	2	—	2	—	—
" fish	15	12	—	9	—	—
" grass	3	1	—	1	—	—
" leather	1	1	—	1	—	—
" vegetable	11	8	—	8	—	—
" wire	4	8	—	3	—	—
Dagger	49	39	—	27	2 sheep or goat	1
" sheath	3	1	—	1	—	—
Dibble	4	3	—	3	—	—
Door-panol ..	6	3	—	3	—	—
" frame ..	1	—	—	—	—	—
Earth	1146	831	14	651	20 sheep or goat 8 ox or buffalo 2 cat 1 dog 1 pig	19
Fan	1	1	—	1	—	—
Fæces of tiger (sup- posed)	1	—	—	—	—	—
Feather	2	2	—	1	—	—
Fibre, aloe	1	—	—	—	—	—
File	2	1	—	1	—	—
Flesh	13	—	—	7	1 ox or buffalo 1 goat 1 horse	—
Flesh, cooked ..	2	—	—	—	1 ox or buffalo	—
Fluid (suspected to be blood-stained)	3	3	—	3	—	—
Fork	1	—	—	—	—	—
Fruit	2	1	—	1	—	—
Glass, pane	4	4	—	4	—	—
Gourd	1	—	—	—	—	—
Hair, not adherent to weapon	14	20	—	35	1 insect 1 feline 1 vegetable-fibre	—

	Total	Blood stained.	Non-mammalian	Source of blood		
				Mammalian		
				Identified		Not identified as to exact source
				Human	Not human	
Hair pin	1	—	—	—	—	—
" tuft of Hindu	1	1	—	1	—	—
Halbert	6	3	—	2	—	—
Hammer, mallet	14	13	—	9	—	—
Harness	9	4	—	3	1 ox or buffalo	—
Hat, cap, turban	197	160	1	145	3 ox or buffalo	1
Hoe	1	1	—	1	—	—
Hook	2	—	—	—	—	—
Implement, farm	6	2	1	1	—	—
" wooden	1	1	—	1	—	—
Iron, bar	5	3	—	3	—	—
" fragment	4	2	—	2	—	—
" hoop	1	—	—	—	—	—
Jewellery	104	83	—	78	—	2
Jute	2	1	—	—	—	—
Key	2	1	—	1	—	—
Kitchen utensils	16	10	—	9	—	—
Knife	316	259	5	197	9 sheep or goat 5 ox or buffalo	11
" sacrificial	6	1	—	1	—	—
Kukri knife, Gurkha	12	5	—	5	—	—
" shatb	2	—	—	—	—	—
Ladder	1	1	—	1	—	—
Lamp, lantern	4	2	—	2	—	—
Lamp-stand	1	1	—	1	—	—
Latch, wooden	2	2	—	2	—	—
Leaves	116	91	2	77	2 sheep or goat	1
1 mammalian and non-mammalian.						
Letter	1	1	—	1	—	—
Lint	1	1	—	1	—	—
Match	2	2	—	2	—	—
" box	3	3	—	3	—	—
Matting, carpet	134	102	5	88	5 sheep or goat	2
Micro-slide	1	—	—	—	—	—
Nail-parings	49	6	—	6	—	—
Nuts	3	3	—	3	—	—
Paper	7	5	—	5	—	—
" currency note	1	—	—	—	—	—
" dispensary ticket	2	2	—	2	—	—
Pencil	1	1	—	1	—	—
Pestle	2	2	—	2	—	—
Pickaxe	7	4	—	2	—	—
Pipe, huqqa	4	4	—	4	—	—
Pistol	2	1	—	1	—	—
Plants, various	37	32	—	30	1 ox or buffalo	1
Plates	1	1	—	1	—	—
Playing cards	4	4	—	4	—	—
Polo stick	1	1	—	1	—	—
Pot, earthen	30	21	—	18	—	1
" brass	12	9	—	8	—	—

	Source of blood.				
	Total	Blood stained	Non-mammalian	Mammalian.	
				Identified.	
				Human	Not human.
Pouch	3	3	—	3	—
Powder	1	1	—	1	—
Rafa	1	1	—	1	—
Razor	45	34	—	29	—
Reading-stand for Quran	1	1	—	1	—
Reed ..	1	1	—	1	—
Rice-pounder	5	5	—	5	—
Rod, metal	1	—	—	—	—
Roller	1	1	—	1	—
Sacking	63	56	—	47	1 sheep or goat
Sail boat	1	—	—	—	—
Saliva .	1	—	—	—	—
Sand	23	20	—	16	—
Saw ..	2	1	—	1	—
Scissors	2	—	—	—	—
Seeds	1	1	—	1	—
Serum	1	—	—	—	1 goat, not sheep
Shells	1	—	—	—	—
Shepherd's crook	1	—	—	—	—
Shoes, sandals	61	37	—	31	—
Shovel, fire	2	1	—	1	—
Shrine of Langam	1	—	—	—	—
Sickle	134	70	2	59	2 sheep or goat
Skin ..	4	1	—	1	1 cat
Slate ..	1	1	—	1	—
Spade, kodali	80	52	—	43	1 sheep or goat
Spear	36	23	—	19	—
" fish	4	2	1	1	—
Spectacles ..	1	1	—	1	—
Staple ..	1	—	—	—	—
Sticks, bludgeons	156	121	2	98	7 sheep or goat 1 ox or buffalo and human
Stones ..	309	235	1	244	7 ox or buffalo 6 sheep or goat
" grinding	1	1	—	1	—
Straw, grass ..	78	70	10	52	3 sheep or goat 1 ox or buffalo 1 pig
Sugar cane ..	2	—	—	—	—
Sweetmeat ..	1	—	—	—	—
Sword	124	104	1	91	1 sheep or goat
" belt ..	1	1	—	1	—
" scabbard ..	24	12	—	11	—
" stick	1	—	—	—	—
Table ..	1	—	—	—	—
" cover ..	1	1	—	1	—
Teeth ..	2	2	—	2	—
Thread ..	9	7	—	7	—
" sacred, off Hindu	2	2	—	2	—
Tin box	1	—	—	—	—

Source of blood

	Total	Blood-stained	Non-mammalian	Mammalian		Not identified as to exact source
				Human	Not human	
Tin chips	1	—	—	—	—	—
Toddy tapper	18	9	—	8	—	—
Hone for	2	3	—	1	—	1
Tongs	3	3	—	3	—	—
Tools, iron	1	—	—	—	—	—
Torch holder	2	2	—	2	—	—
Trunk, steel	2	2	—	2	—	—
" wooden	1	1	—	1	—	—
Tub	1	1	—	1	—	—
Twigs	18	15	—	13	1 sheep or goat 1 ox or buffalo	—
Tyre	1	1	—	1	—	—
Umbrella, sunshade	12	5	—	5	—	—
Vaginal discharge	2	1	—	1	—	—
Washings of clothes	6	2	—	1	—	—
" hands and feet	4	—	—	—	—	—
Wax, sealing	1	—	—	—	—	—
Weight, iron	1	—	—	—	—	—
Wheel	4	1	—	—	—	—
Wire, fencing	2	—	—	—	—	—
" fragments from exploded bomb	3	1	—	1	—	—
Wood, billets, planks	303	187	10	161	4 sheep or goat 2 ox or buffalo 1 goat	—
Yoke of ox cart	2	2	—	2	—	—
Undetermined substance	13	9	—	6	1 sheep or goat	—
Grand total	13036	9595	93	8108	2 ruminant 74 ox or buffalo 1 ox or buffalo and human 2 ox and human 150 sheep or goat 5 sheep and human 3 goat 1 goat and human 2 horse 1 camel 3 dog 4 cat 2 pig 1 insect hair 1 cat's hair 1 vegetable fibre	195

2 also mammalian

Illustrative Cases.

1. From Murshudabad were sent some earth and paddy (unhusked rice) which were suspected to be blood-stained. The accused person, to whom the paddy belonged, stated that if it and the earth were stained with blood this must have come from a fowl which he had killed at a place where the floor of that place. The blood in the earth and on the erythrocyte-nuclei were found, erythrocytes and elliptical erythrocyte nuclei were present. One of the grains had both on it, and, curiously enough, both were present in one field of the microscope when a preparation of this grain was made. Further examination showed that the mammalian blood present was of human origin.

The mammalian corpuscles which were present were found to be of human and not ruminant origin, and thus the explanation given by the accused person was proved to be a pure invention.

3. From Dacca in a murder case were sent four specimens of earth and a bamboo that were suspected to be stained with blood. On the bamboo and two of the specimens of earth—one of which had a human hair on it—no blood was found. In one of the remaining specimens of earth were found elliptical erythrocyte-nuclei. This earth was from a spot which the owner of the house, from which it was taken, said had been stained with pigeon's blood. The other specimen showed mammalian erythrocytes, but these were not proved on further examination to be of human origin. At least the story about the pigeon's blood was probably true.

4. In a murder case from Diamond Harbour there was sent the loin-cloth of a man who had been seen in the company of the murdered woman shortly before her death. He admitted that the cloth was blood-stained, and explained that this was due to his having killed a duck some time before. Examination showed that in the stains there were present only elliptical erythrocyte-nuclei, and thus his story was corroborated.

5. In Jhelum a man accused another of attempted murder, alleging

6. From Dinajpur was sent a cloth which a Sonthal woman alleged to be stained with her blood, shed when she was ravished. The stains were found to be due to non-mammalian blood alone—and no semen was found on the cloth. However, the Magistrate found that the case was true. But he also found that sufficient evidence was not forthcoming against the two men whom the woman had accused of having committed rape.

7. Some sweetmeat, which was supposed to have been mixed with menstrual blood, in order that it might act as a love-philtre, was sent for

examination by the man who believed that his affections were being played upon in this manner. There was **no blood present** in the sweetmeat, which consisted of ghl and sugar.

8. A man alleged that he had been cut down with a bill-hook by dacoits and that the blood shed by him had stained some **straw**, which was sent for examination. The straw was found to have only **non-mammalian blood-stains**, and the case was dismissed as false by the Court.

9. A girl said that she had been ravished by three men, and that each of them had had intercourse with her, with profuse ejaculation, while she was held down by the other two. Her **loin-cloth** was stained with blood, but not with semen. The blood was **non-mammalian**, so the charge of rape was not pressed.

10. Some **earth** that had been taken from near the spot where a corpse had been found was sent for examination. The defence was that if blood was present in the earth it must be that of a fowl. There was only **non-mammalian blood** present in the earth.

blood was due to his mistress having been **menstruous** at the time of their last meeting. However, although according to his account the **baisan** had lasted for some time, he was unable to give the woman's name. On the trousers were found stains which were due to **human blood** and to

due to its having been used as a "**diaper**" by his daughter, who was then **menstruating**. **Mammalian erythrocytes** were found, but further examination showed that these were not human, but of a sheep or a goat—most probably the latter. The man's story was thus proved to be absolutely false.

13. From **Dunajpur** in a murder case were sent two specimens of **earth** and seven pieces of **bamboo**. The owner of the house from whose yard and veranda the earth had come, and in whose room the bamboos were found, explained that if there were blood found on the articles it was probably that of an **ox**. Careful examination failed to detect **mammalian erythrocytes**, but large **elliptical erythrocytes** and their nuclei were present in great numbers in the stains on the pieces of bamboo. In the specimens of earth blood was present, but no erythrocytes could be found. Further examination showed that none of these articles had been contaminated with **human blood**. The truth of the explanation given was thus established.

14. From **Purnea** was sent a bunch of **jute-plants** which were suspected to be stained with blood of an **ox**, the case being one under section 429 f P C. **Human blood** was totally excluded by the results of the examination, which showed further that the blood on the plants was due to **buffalo's or ox's blood**.

15. The police of **Purnea** sent for examination two **sickles**, some **earth**, and a **bamboo**, which were suspected to have blood-stains on them. The origin of the blood was held to be doubtful. I was asked whether, if any were found present, it had come from a **human being** or a **fowl**. On one of the sickles no blood was present. On the other articles there was blood, which showed many **elliptical erythrocytes** with nuclei, but no **circular erythrocytes**. The **stain-extracts** did not react with anti human

serum. Obviously the police had in this case good grounds for their doubts.

16. From Madras were sent scrapings of a blood-stain on the plaster of the wall of a cow-house, in which a man was alleged to have been murdered. I found that the stain was due to the blood of a ruminant and not to that of man. Further investigation, carried out at the suggestion of the Chemical Examiner, Madras, showed conclusively that human blood smeared on the plaster was easily identified as human blood—the plaster itself was not contaminated by reason of its site, so as to mask the reaction for human blood, and thus lead the observer into error.

17. The loin-cloth of a man who was accused of having committed murder was found to be stained with what looked like blood. He said that if it were really blood it must have come from bugs or other blood-sucking insects which he had found on the cloth and crushed. The stains were found to be due to human blood, but not to contain any vestiges of insect structure. When the case came to be tried he changed his story and stated that the loin-cloth was stained with the blood of his son, who had been kept standing in the sunlight until his nose bled, by the police who had tried to force him to bear false witness against his father. The Court found that both stories were false, but was compelled to quit the

pointed out to the police as the scene of the riot, so that suspicion might be removed from the actual aggressors. The earth was stained with the blood of an ox or buffalo alone. The fact was that those interested had slaughtered the animal at that spot, with the intention of misleading the police.

19. A quilt and a towel were sent for examination in a murder case. The defence was that if these articles were blood-stained the blood had come from sores on the body of one of the persons accused. The quilt was found to be stained with human blood. The towel, which had been carefully washed, was found to be stained with mammalian blood, whose source could not be accurately determined. As no trace of pus-cells was found on either article the story told by the counsel for the defence was not corroborated by the findings in the laboratory. The chief actors in this murder were sentenced to death.

our opinion he had produced, with some effort, an ejaculation while he was wearing the garment, in order to prove his innocence and our ignorance with regard to the first garment sent for examination.

21. A man was dragged out of his house and murdered in the street. One of his assailants was found to have bloodstains on his clothes. These stains were, he asserted, due to the blood of a bullock, which he had slaughtered; but we found that they were due to human blood alone. The Jirga, to which the case was referred, found him guilty.

22. A man, who was suspected to have committed a murder, stated that if any blood were found on his clothes it must have come from one of his camels. The clothes were stained with blood, which showed only circular erythrocytes, and was found to be of human origin alone.

23. The clothes of a man who was arrested on a charge of having committed a murder were stained with blood, which he stated was that of a cow recently slaughtered by him. This was only part of the truth, however: the stains were found to be due to the blood of an ox or buffalo, and to human blood.

24. The police suspected that if any blood were present on some earth which was sent for examination, it was that of a youth that had been murdered by a man who used to have homosexual relations with him,

with the blood of an ox or buffalo alone. The person accused was discharged.

25. In B's house was found an axe whose blade was thickly smeared with blood. B admitted that he was the owner of the axe, but professed entire ignorance of how it came to be lying where it was found, and to be blood-stained. On the blade was found a hair which had come from the ear of a black goat, and the blood present was found to be of a sheep or goat alone. B was released from custody. A, who had tried to fix a false charge of murder on him, is still a free man.

26. A lad of twenty was accused of having ravished a girl of eight. No seminal stains were found on her garments, and the blood with which they were stained were found to be that of sheep or goat alone. The Judge admitted that this fact cast grave doubts on the other evidence, but convicted the lad and sentenced him to three years' rigorous imprisonment and a fine of ten rupees, or—in default—two months' rigorous imprisonment.

27. For examination was sent some earth which was dug up from the alleged site of a rape committed by a boy of 14 on a very young girl. An eye witness testified to the rape, and the medical evidence showed that the girl had sustained injuries on her genitals, but the earth was found to be stained only with the blood of a sheep or goat, probably the latter. The boy received 15 stripes for indecent conduct.

28. The body-cloth of the alleged victim of a rape was found to be stained with non-mammalian and mammalian blood, which was certainly not of human origin. The Magistrate discharged the person accused, remarking that "the medical evidence makes it almost certain that the girl was raped, but the Chemical Examiner's report throws some doubt on it."

29. In a riot case was sent for examination some earth, which was alleged to be stained with the blood of a man who had been speared while defending his crops. The earth was found to be stained with the

years' rigorous imprisonment, the counter-charge, brought by them as innocent defenders of their rights being dismissed as false.

30. In an assault case were sent two specimens of earth. The complainant had pointed out the place where he had been beaten, and the earth of this place was dug up. On the next day the alleged assailants pointed out a spot in another field, which they said was stained with

the first field was found to be stained with human blood alone, that from the second field was stained with human and hircine blood. The persons

Monday his nose had bled. However, on the Sunday preceding that Monday it had been duly recorded that his loin-cloth was stained—the

that it used to bleed once a month. The owner of the coat explained that the stains on its front—three—were due to the blood of a water-fowl, which one of his friends had shot about a month before the date of the murder. Two of these stains were due to human blood alone; the third was due to the blood of a mammal, whose species could not be determined. On the back of the neck of the coat was found a stain due to the blood of an ox or a buffalo. One of this man's cows had been gored by another, and he had dressed its wounds. It is probable that, while bending down to do this, he had got the blood on his coat-collar. The owner of the loin-cloth and the owner of the coat were transported for life.

33. A man complained that he had been beaten, and pointed out the place where his blood had been shed. The police suspected that the earth was stained with dog's blood. It was found to be stained with

to be entirely free from blood.

34. One Gajru was asked to give an account of his movements during the period immediately prior to the finding of the corpse of an old woman. He told a long story, in which he made no mention of one Nandlu. Nandlu, on being questioned in Gajru's presence, told that he had seen Gajru following the woman on a certain morning—5 days previous to the visit of the investigating police officer. When Gajru heard this story, he promptly recollected that on the morning in question he had watched Nandlu and two other men, whom he named, following the woman. The spot from which he said he had seen them was held to be too far away for him to identify any one who was walking where he said those men were observed. Later he told how he had seen Nandlu and the others kill the woman. An axe and two clothes which

35. Two castes in a Madras village had quarrelled. The Nadars

had no relatives to avenge her death, so she was beaten to death, after a telegram had been sent from the nearest Telegraph Office to the district authorities about her having been murdered at the temple by the Naickers. In order to prove this story to be true, the Nadars slaughtered

of an ox or buffalo alone. The owner of the knife stated that he had recently cut up buffalo flesh with it. The persons accused of the murder were discharged.

37. In an assault case there was found a blood-stained cloth, hidden under the fodder in a manger which belonged to one of the persons accused. He explained that the cloth was stained with the blood of one of his sheep; but it was found to be stained with human blood alone, a fact on which the Court laid great stress. Two of the five persons accused were sentenced to rigorous imprisonment for one year.

38. A man complained that his father and brother had been beaten by certain men while asleep in his house. The police discovered that a fight had occurred in the roadway and not in the house, the house having been chosen as its scene in order to add to the assault a charge of housebreaking. The soil of the roadway was found to be stained with human blood.

39. Three men were accused of having committed culpable homicide. In the case an important point was the scene of the killing, which the prosecution suspected to have taken place at the victim's threshing floor, but the defence alleged to have occurred on the river bank, where they showed a blood-stained place to the investigating police officer. The earth of this place was found to be stained with the blood of a sheep or

he was wearing at the time. The Medical evidence showed that the wound was caused by a sharp instrument and not a blunt one, such as a lathi. The cloth was stained with non-mammalian blood alone. The man was tried on the charge of fabricating false evidence and sentenced to two years' rigorous imprisonment.

41. A man stabbed his wife and her lover, who died a few days afterwards. He fled, but was caught, and explained that if the stains on his clothes were due to blood, it was that of a cow. The garments were found to be stained with human blood alone. He was sentenced to five years' rigorous imprisonment.

42. Three men were accused of having murdered a man. A owned a field, in which a spot was stained with what turned out to be human blood. The earth of a field belonging to B was also stained with human blood. The Khalka, patka, and pyjamas of C were found to be stained. He explained that the stains on the Khalka were due to snuff—they were

accused of the assault were convicted

of the struggle. The earth from A was found to be stained with human blood; the earth taken from two places at B was found to be stained with bird's blood alone.

32. In a murder case a loin-cloth and a coat were sent for examination. The owner of the loin-cloth stated that it was stained with the juice of the fruit of *Phyllanthus emblica*. When he learned that the stains had been found to be due to human blood, he remembered that on a certain Monday his nose had bled. However, on the Sunday preceding that

that it used to bleed once a month. The owner of the coat explained that the stains on its front—three—were due to the blood of a water-fowl, which one of his friends had shot about a month before the date of the murder. Two of these stains were due to human blood alone, the third was due to the blood of a mammal, whose species could not be determined. On the back of the neck of the coat was found a stain due to the blood of an ox or a buffalo. One of this man's cows had been gored by another, and he had dressed its wounds. It is probable that, while bending down to do this, he had got the blood on his coat-collar. The owner of the loin-cloth and the owner of the coat were transported for life.

33. A man complained that he had been beaten, and pointed out the place where his blood had been shed. The police suspected that the earth was stained with dog's blood. It was found to be stained with blood, which had become too disintegrated for an opinion as to its source to be formed. The person accused stated that there had been an

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he said those men were observed. Later he told how he had seen Nandlu and the others kill the woman. An axe and two clothes which belonged to Nandlu were sent for examination. The clothes were not blood-stained; the axe was stained with the blood of sheep or goat alone. Nandlu and the others were discharged.

35. Two castes in a Madras village had quarrelled. The Nadars

determined to start a riot, to report that he had been in worshipping the soldiers

a sheep in front of the temple. When the police managed to get sufficient evidence to warrant the arrest of certain men, one of these was found to have blood-stains on his loin-cloth. These were found to be due to human and ovine blood. The persons accused were acquitted for lack of sufficient evidence to corroborate the story of the approver.

36 There was sent for examination a knife which was suspected to have been used in a murder. It was found to be stained with the blood of an ox or buffalo alone. The owner of the knife stated that he had recently cut up buffalo flesh with it. The persons accused of the murder were discharged.

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lath. The cloth was stained with non-mammalian blood alone. The man was tried on the charge of fabricating false evidence and sentenced to two years' rigorous imprisonment.

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found to be due to human blood. The stains on the patka and pyjamas he said were due to rust. The patka was stained with human blood; the pyjamas had been well washed, but we were able to report that they were stained with the blood of a mammal, whose species could not be determined.

43. A man reported that his master had been killed while sleeping at the threshing floor. He was found to have stains, which seemed to be due to blood, on his clothing, and cuts on the palmar surface of the fingers of his right hand. He pointed out to the investigating police officer where the grass-chopper, with which the deed was done, was lying in the house of the deceased. He confessed his guilt to a Deputy Magistrate, who noted that he had taken care to ascertain that the confession was made voluntarily, and explained that it would not lead to the man's discharge, also that he had ordered the prisoner's handcuffs to be removed, and had kept him for half an hour in Court—whence all policemen had been excluded—before recording the confession. On the fourth day after the murder was committed the cuts on the man's

the police had told him that he would get off scot-free if he did so. At the Sessions trial he stated that there must have been a snake or a scorpion concealed in the grass that he had been chopping, and that its blood had stained the chopper. We found that the rag was stained with human blood alone.

He also stated that he had never made a confession, but that the Deputy Magistrate had taken down a statement that was dictated by the two constables who took him to Court. As to the murder, his story was that it had been done while he was asleep, but he had seen three men
 1 noise
 1 fy the
 1 I him

to inflict the injuries. The owner of the billhook and his mother stated that they used it to cut beef some four days before the date of the murder, and to cut up a fowl on the day following the murder. On the blade were found stains of the blood of an ox or buffalo alone.

45. A man was accused of having committed house-trespass by night. On the floor of one of the rooms, and on the floor of the verandah, the investigating police officer found what looked like blood-stains. The owner of the house stated that these had been caused by the blood shed by the accused person, whom his wife had struck with a billhook. The accused person denied this, and said that he believed that the blood was that of a cat, produced ad hoc by the owner of the house, who desired to get him into trouble. The earth from the room and verandah floors was found to be stained with cat's blood alone.

As an instance of how the police, who receive very little aid from the general public in this country, are forced to utilize every scrap of what might turn out to be a *pièce à conviction* in a murder case, I may mention that from Diamond Harbour I

received (1) some palm-leaves; (2) a bamboo cane; (3) some bamboo matting; (4) two bamboo poles; (5) a cloth; (6) a piece of rope, and (7) a dhoti. All of these were suspected to be blood-stained. On none was there any blood detected, but on the cane were found stains very much like those of blood at first sight, but really due to betel-stained saliva.

CHAPTER VII

ASPHYXIAL DEATHS.

THE violent deaths which result from asphyxia more or less directly are: (1) Hanging, (2) Strangulation and Throttling, (3) Suffocation, and (4) Drowning.

The *post mortem* signs of asphyxia are—

External. (1) Lividity of lips, finger-nails, and skin, to be distinguished from hypostasis by not being confined to the most dependent parts. (2) Prominence of eyes, especially in strangulation. (3) *Rigor mortis*, slow in onset. None of these are very characteristic.

Internal. (1) Blood unusually fluid from excess of carbonic oxide. (2) Lungs and meninges may be either congested or anæmic. (3) Petechiæ beneath serous membranes.—These minute extravasations of blood, from the size of a pin's head to a small bean, beneath the pleural covering of the lung ('*Tardieu's spots*') or under the pericardium, are very characteristic of asphyxia, if the deceased was not previously suffering from blood diseases, such as scurvy and purpura, in which petechiæ are apt to occur. They may, however, be absent in undoubted asphyxia, and are most likely to be present when the asphyxia occurs rapidly. They should be looked for especially at the root, base, and lower margin of the lungs, on the pericardium, under the scalp, and in infants on the thymus gland. They are readily distinguished from hypostasis by their punctate or petechial character.

Hanging.

In this form of asphyxial death the body is suspended by the neck and the constricting force is the weight of the body or head. It is unnecessary that the body should be suspended off the ground or other support, or even that it should be in the upright posture.

Suicidal hanging is a relatively rare form of suicide in all countries. In India, statistics show that between one-third

and one-half of the suicides of both the sexes in the town of Calcutta and in the Panjab, and of the male suicides in the presidency of Madras, hang themselves, whilst in Bombay suicidal hanging is rare. Hanging also is the mode selected by about 18 per cent of the female suicides in the two last-mentioned presidencies. All the 130 cases of hanging seen by Dr. Mackenzie¹ during nine years in Calcutta were suicidal. Sixty-five were male and sixty-five were female, and all were adults. The alleged causes in these cases were:—

Family disagreement	38	Remorse at having led immoral	
Ill-health ..	35	lives	2
No reason assigned	21	Grief on account of the death	
Drunkenness	9	of a near relation ..	1
Insanity	9	Serious illness of a child	1
Poverty	4	Disappointment in love	1
False accusation	2	Jealousy	1
Found in possession of counterfeit coins .	2	Theft	1

The nature of the rope by means of which these 130 persons committed suicide: seventy-three used ropes of various material and thickness. Thirty suspended themselves by means of their *dhoties*, *saries*, or *chadars*. Twenty-five cases were not noted. One person, a determined suicide, used both a rope and the cloth he wore to destroy himself, and a Brahman hung himself by his Brahmanical thread!

. big, stout
 , and com-
 he family,
 house into
 the outer courtyard, where he entered a cowshed and hanged himself. He twisted his Brahmanical thread into several ply, and was found suspended off the ground by means of it. The mark of the cord round the neck corresponded with the Brahmanical thread. It was very narrow and deeply indented into the skin of the neck, which was parchment-like in appearance.

Homicidal cases are rare in India, except in lynching. Chevers mentions three, one where a woman, with the aid of three men, hung her husband in revenge for having beaten her some days previously, another where a husband hung his wife as a punishment for adultery, and a third where the inhabitants of a village, discovering a man from a neighbouring village in the act of committing a theft, hung him on a tree in the middle of their village. More frequently in India, in homicidal cases where the body is found hanging, the cause of death is strangulation or mechanical violence, and the body has been hung to avert suspicion (see *Cases* next page). Accidental cases also are rare, but are sometimes met with. Judicial hanging—this is the judicial mode of execution in India.

¹ *Ind Med Gaz.* 1883, p 292.

managed to escape. The paramour, enraged at having been summoned and beaten before the *panchayat*, pursued her with three of his relatives. On coming up with her, they strangled her, and, hanging her body on a tree hard by, reported that she had committed suicide.—Chevers, *Med Jur*, p. 529.

Case—The father and brothers of a girl, of Tipperah, finding her in company with a man with whom she was intriguing, seized the man, and, holding him down by the neck, arms, and legs, strangled him. They then hung up the corpse, and reported that he had destroyed himself.—Chevers, *ibid.*, p. 592.

Post mortem examination and not by hanging, was

Case—Murder by mechanical violence; subsequent suspension of the body.—A man of Sylhet struck his wife with a piece of split bamboo

man out of his house at night, killed him, or rendered him insensible (it would seem by severe blows), and suspended his body to a tree.—Chevers, *ibid.*, p. 598.

Case.—It appeared, in a trial at Cuttack, that a Hindu, charging another

Hindu, aged about sixty. *Post mortem* appearances—"Face livid and slightly swollen, especially on right side, on which the body had been laid. The tongue was not swollen or bitten by the teeth. A bruise about $1\frac{1}{2}$ inch in diameter on right side of the forehead. A livid depressed mark, about $\frac{1}{2}$ inch in diameter, round the neck and behind right ear. In front of the neck the mark was between os hyoides and thyroid cartilage. There was another depressed mark under the forehead. *Head*—Considerable amount of coagulated blood in tissues of pericranium, corresponding to bruise on forehead. Brain healthy, slightly congested on surface

fractured in two places on both sides; lungs healthy, uncongested, heart empty. *Abdomen*—Extensive rupture of liver on its posterior aspect, all other organs healthy."—Harvey's *Beng. Med. Leg. Rep.*, p. 83.

was lifted. The right lung was torn through from apex to base, and a circular hole, of the same size as the one in the neck, passed right through the liver. The right kidney was bruised, but not wounded. A large quantity of blood was found in the cavity of the thorax, and a large quantity also in the abdomen. Deeming the wound a gunshot wound, the medical officer, not being able to find the bullet, gave as his opinion that it had probably passed behind the kidney into the thigh. The woman's husband afterwards confessed to having killed his wife, by thrusting a pointed perfectly circular solid bamboo into her body. The body was afterwards hung up to avert suspicion—*Ibid.*, p. 214.

lun;
the
by lying in an inclined position—Prof. Powell, Bombay.

Case—Accidental hanging.—"During the breakfast hour at a cotton mill near Aberdeen, one of the men was toying with a female fellow-worker to whom he was attached, and in sport threw around her neck a loose leather strap suspended from the roof of the apartment. At this moment the machinery was set a-going, and the girl was drawn up to the roof of the strap, and suspended there for a few minutes before the engine could be stopped, too late for saving her life"—*Ibid.*, p. 523.

Case—Death from hanging—Arsenic found in viscera, probably self-administered.—In a case from Shahapur (Thana district), the body of a Mahar was found hanging to a tree outside a village. On examination, there was found an abrasion of the skin round the neck just below the chin, commencing from the thyroid cartilage, and extending backwards and upwards on both sides, with discoloration of the parts around. Both lungs were found gorged with blood, and the brain was congested. The mucous membrane of the stomach was red, and had yellow patches on it. On analysis, arsenic was found in the viscera, about four grains being present in the contents of the stomach.

Mode of death in hanging depends on the way the cord is applied, and on other circumstances. It may be by—

1 **Fracture or dislocation of cervical vertebrae,** followed by almost instant death from pressure on the spinal cord. This occurs when the body falls some distance before the strain comes on the rope, and is the mode of death sought to be attained in judicial hanging.

2 **Asphyxia,** from constriction of the air passages, with rapid death. Death from pure asphyxia does not often occur in hanging, though Dr Mackenzie states it was the most common mode in his 130 cases.¹ It may, however, occur if the rope is tied low down the neck, and a knot or some hard object contained in the ligature presses directly on the trachea.

3 **Apoplexy,** from pressure of the ligature on the large veins of the neck, if the tape is tied too high up the neck.

4 **Mixed asphyxia and apoplexy.**—This, except in judicial hanging, is the most common mode of death, occurring in about 77 per cent. of

¹ *Loc cit Ind Med Gaz.*, p. 599

those cases of death from hanging in which the cause of death is other than fracture of the neck.

In Dr. Mackenzie's 130 cases no less than 119 or 91·54 per cent died from asphyxia, 8 or 6·15 per cent from asphyxia, as well as apoplexy; 2 or 1·53 per cent from syncope, and 1 or 0·76 per cent. from apoplexy.

Rapidity with which death occurs varies—It occurs almost instantaneously if the neck is fractured, rapidly if death takes place by apnoea; and least rapidly if apoplexy is the mode of death. If there is no injury to the spinal cord, and the stoppage of air is not complete, five to eight minutes is the common fatal period; but it is possible that life may be restored after even half an hour's suspension¹

Treatment.—As in Drowning, which see. In addition, moderate bleeding may be employed to relieve cerebral, or general venous congestion

Post mortem signs.—These are generally those of asphyxia with the special signs in addition

1. **Signs of the 'mode' of death,** *e.g.* fracture or dislocation of the cervical vertebrae; or the *post mortem* appearance of asphyxia or apoplexy, one or both

In all the 130 suicidal cases examined by Dr. Mackenzie no fracture or dislocation of the neck was found, but the following case is reported by Dr. H. G. Johnston of Jamaica, W I

Case—Fracture.—Dislocation in suicidal hanging—A negro aged 24 (D McL), a sufferer from extensive chronic ulcer of the leg, climbed a tree and tied a thin ($\frac{1}{2}$ inch diameter) bark rope to a horizontal branch, and put the other end of the rope by a slip-noose around his neck, and threw himself down about a five-foot drop. When found, his feet were only a few inches from the ground, the knot being behind the left ear. There was a fracture-dislocation of the axis

2 **Mark of cord**—This in death from hanging is usually, but not always, oblique and non-continuous, *i.e.* does not completely encircle the neck. It is usually (in about 81 per cent of cases) situated between the chin and the larynx, and is very seldom (in about 2 per cent of cases)

red, and the skin beyond violet; or (c) if the period of suspension has been long, be dry, hard, yellowish-brown, and horny, resembling parchment.

In Dr. Mackenzie's cases in which a rope was used, the mark on the neck was well defined, indented, and parchment like, while in the cases where cloth ligatures were used, the marks were faint, of a reddish colour, and not parchment-like, except in places where the cloth was twisted, and where the pressure was great.

¹ Tidy's *Legal Medicine*, II. p. 191.

Abrasions are sometimes found in the course of the mark, but ecchymosis is rare, and sometimes *there may be no mark*. After noting the

made also in all cases where strangulation is suspected.

In not one of Dr. Mackenzie's 130 cases were the muscles of the neck,

the body falls some distance before the strain comes on the cord. Such cases excepted, much local injury points to strangulation rather than to hanging, or if hanging be the cause of death, to homicidal, rather than to suicidal hanging.

the teeth, or partly protruding between them and bitten. Genital organs frequently show signs indicative of excitement, accompanied by discharge of mucus, or sometimes of blood, and in males by emission of seminal fluid. Expulsion of urine and faeces sometimes takes place. Lungs.—Congestion of the lungs is by no means invariably present. Out of 834 cases of death from hanging, included in the returns reported on by Harney, in 738 the lungs were congested, in 77 natural, and in 19 collapsed. Rupture of the superficial air cells, spots of sub-pleural ecchymosis, and apoplectic effusions into the substance of the lungs, are all infrequent in hanging, but may be present.

Saliva running in straight lines down the chin and chest are usually found, and if present, are important as indicating suspension during life.

In Dr. Mackenzie's 130 cases, in 81 the position of the tongue was

per cent the eyes were open, and the eyeballs were protruded. In 21 cases frothy mucus was looked for around the mouth and nostrils, and in 20 or 95.23 per cent. it was found, 91 cases were noted regarding two lines of mucus at the angles of the mouth, and it was present in 23 or 25.57 per cent. The condition of the fingers was noted in 42 of the persons hanged, and they were found to be flexed or clenched in 17 or 40.47 per cent. The condition of the nails was noted in 15 cases, and in every one of them they were found to be of a blue colour. In 92 cases 50 or 52.60 per cent. had vaginal or urethral discharges. Out of 23 cases noted, 8 or 34.78 per cent. had discharge of faeces from the rectum. In 8 cases the condition of the penis was noted, and in 3 or 37.50 per cent. it was found to be erect. The hyoid bone was found fractured in 24 cases or 25.50 per cent. out of total of 93 observed. Notes were made regarding the

the cricoid cartilage in to be fractured. Of . . . were observed, in . . . In 16 or 51.61 per 12.90 per cent. the middle coats, and in 11 or 35.48 per cent. both the internal and middle coats, were ruptured.

Questions regarding Hanging.

The chief medico-legal questions connected with death by hanging, are:—I. Was Death due to Hanging? and II. Was the Hanging Suicidal, Accidental, or Homicidal?

I. Was Death due to Hanging?

With reference to this question, it may first be pointed out that in a case of death from hanging, where the period of suspension has been short, or a very soft ligature has been used, there may be no mark at all on the neck. Hence the absence of a ligature mark on the neck does not absolutely contra-indicate hanging as the cause of death.

A ligature mark on the neck does not necessarily indicate suspension of the body (see 'Strangulation,' p. 213); but when due to suspension of the body, it is, as a rule, high up on the neck, oblique, and non-continuous. Suspension of the body, therefore, is indicated by the presence of a ligature mark on the neck, with a force proportionate to the degree of agreement of the mark with these characters. In very exceptional cases, however, a mark, possessing all these characters, may be produced without suspension; e.g. when the body has been dragged along the ground, during life or after death, by a ligature round the neck. In such a case, abrasions of the skin due to the dragging will probably be found (see *Case*, p. 155). Suppose, however, suspension of the body to be proved by direct evidence, or strongly indicated by the characters of the ligature mark on the neck, death may yet have been due to a cause other than hanging, and the suspension of the body effected after death. That a ligature mark on the neck, in all respects resembling the mark left by the cord in a case of death from hanging, may be produced by suspension of the body after death has been amply proved. Casper found that bodies were suspended within states that an ecchymosed mark may be produced and a non-ecchymosed mark within six hours after death. This being so, to establish the fact that death was due to hanging, requires not only proof of suspension of the body, but also

proof that such suspension was the cause of death. Such proof may be afforded by the presence of the general *post mortem* appearances, already enumerated, of death from hanging. If these are absent, careful search should be made for the presence of signs of death from a violent cause other than hanging. This is extremely important, as murder cases are not infrequently met with in India, in which the murderer suspends the body of his victim after death, with the object of imitating suicidal hanging (see *Cases*, p. 206). In such cases (see first *Case*) the cause of death sometimes is strangulation, and when this is so, the general *post mortem* appearances present may closely resemble those of death from hanging (see 'Strangulation').

II. Was the Hanging Suicidal, Accidental, or Homicidal?

In cases of death from hanging the presumption is always in favour of suicide, even if the body is found only partly suspended. Numerous suicidal cases are on record, in which the body was found partly suspended, with the feet touching the ground, or in a sitting, reclining, or kneeling posture. Powell mentions a remarkable case of this kind (see *Case*, p. 207). Suicide, however, may be negatived by the body being found suspended in such a manner as to show that the individual could not have hung himself. Again, supposing the *post mortem* appearances to show that death was due to hanging, the discovery of an irritant poison, *e.g.* arsenic, in the body but little affects the presumption in favour of suicide. Harvey mentions two cases in which individuals, after having taken arsenic, hung themselves apparently in order to escape the suffering caused by the action of the poison (see, however, *Case*, p. 207). Death being due to hanging, marks of mechanical violence present on the body only positively contraindicate suicide when the violence indicated is sufficient to have caused immediate insensibility. Mechanical violence short of this, if from its characters self-inflicted, strengthens the presumption in favour of suicide. That suicidal hanging may follow self-infliction of a very severe wound is shown by a case cited by Harvey, in which a man hung himself after inflicting a wound on his throat four inches long, dividing the thyroid cartilage and œsophagus. Non-self-inflicted violence, not sufficient to have caused immediate insensibility, may be present in a case of suicide, and in fact form the motive leading to it. Age of deceased is important, as children rarely commit suicide.

Accidental hanging is rare. It is sometimes, however, met with, chiefly in cases where children have been playing at

hanging. Cases also are recorded where individuals giving a hanging exhibition have been allowed to remain too long suspended, with fatal results. In one case an adult was found accidentally hung in a gymnasium; and a very exceptional case of accidental hanging is mentioned by Ogston (see *Case*, p. 206).

Homicidal cases are also rare.—A few, however, are on record where hanging, pure and simple, appears to have been the cause of death, *e.g.* the three cases mentioned by Chevers, already referred to. In such cases, as a rule, a number of persons are concerned in the murder. A person, however, who is weak, or insensible, or even asleep, may be murdered by hanging by a single other individual. Ogston, for example, mentions a case "where a woman tied a ligature round the neck of her husband while he was asleep, and then pulled him up." Cases are more common where individuals are first rendered insensible (or it may be killed) by mechanical violence, or by strangulation, and then subsequently hung, *e.g.* the Bompard Case in Paris.

The presence of marks of self-inflicted mechanical violence tends, as already pointed out, to strengthen the presumption of suicidal hanging. When marks are present, clearly due to the infliction of mechanical violence by another, such marks may indicate the employment of violence sufficient to have caused (a) death, or (b) immediate insensibility, or (c) insufficient to have caused either of these effects. In case (a) the absence of the general *post mortem* appearances of death by hanging obviously confirms the indication of homicide. In case (b) the general *post mortem* appearances of death by hanging may be present, but still homicide is indicated. In case (c) it is often quite impossible, from the *post mortem* appearances, to arrive at any conclusion as to whether the hanging was suicidal or homicidal.

If strangulation has been employed previous to suspension, evidence of this may be afforded by the presence on the neck, in addition to the mark due to suspension of the body, of marks indicating strangulation (see below). It may here, however, be pointed out that two cord marks on the neck, one having the characters of a strangulation, and the other those of a hanging mark, may be found in a case of simple hanging, if the cord has been passed twice round the neck.

If very severe injuries are found to have been produced by the cord, *e.g.* laceration of the muscles or other underlining soft parts, the presumption is in favour of homicide or a long drop. Much injury to the soft parts may, however, be met with in suicidal hanging, if the individual has arranged matters so that

his body falls some distance before the strain comes on the cord. Homicide is obviously indicated if the body is found suspended in such a manner, or the hands are found secured in such a way, as to show that the individual could not have hung himself.

Strangulation and Throttling.

In strangulation the constriction of the throat is produced by other means than the weight of the body or head. The means used may be fingers (= 'Throttling'), the foot, knee, clothing, etc. Strangulation differs from hanging in that it may be effected without a ligature, *e.g.* by pressure with the fingers, or some hard object. The modes of death in strangulation are the same as in hanging, hence the *post mortem* appearances are also very similar. The main points of difference between the *post mortem* appearances of strangulation and those of hanging are important, as strangulation is usually homicidal, whereas hanging is suicidal.

1. Mark or marks on the neck :—

(1) If a ligature has been used, there will, save in very exceptional cases, be found a mark on the neck. This usually, but not invariably, differs from a hanging mark, in being transverse in direction, low down on the neck, and continuous, i.e. completely encircling the neck. In exceptional cases of strangulation, especially if the body has been dragged by the ligature, the mark may be found high up on the neck, and oblique in direction, like a hanging mark. Again, in exceptional cases of hanging, the mark may be found low down on the neck, and, if the cord has been tightly applied, the mark left by it may be transverse in direction, like a strangulation mark. Abrasions and ecchymoses in the course of the mark, and injury to the underlying soft parts, are much more common in strangulation than in hanging, but the hard yellow brown parchmenty appearance of the skin in the course of the mark is more seldom met with.

(2) Strangulation by manual pressure is tolerably common in India, the victim being usually a child or a female. Where this mode has been employed, marks made by the thumb and

fingers are almost invariably found on the neck; sometimes, however, these marks of violence are only visible on dissection. Usually the marks found on the neck in such cases clearly indicate how the strangulation has been effected.

- (3) Strangulation by compression of neck with a stick or other hard substance, is often met with in India. Usually, one stick placed across the front of the neck is used, but sometimes two sticks are employed, one placed behind, and the other in front of the neck. This mode of strangulation causes a central bruise on the front of the neck, and usually severe local injury such as fracture of the cartilages or hyoid.

2 Asphyxial and other appearances.—The lungs, as in hanging, may be found uncongested. According to Tardieu, patches of emphysema on the surface of the lungs, due to rupture of the superficial air-cells, are invariably, and apoplectic effusions into the substance of the lungs commonly, present in death from strangulation, while punctiform sub-pleural ecchymoses ('Tardieu's spot'), common in suffocation, are rare in strangulation. But Professor Powell's unique experience shows that Tardieu's statements are more emphatic than warranted, as patches of emphysema are *not* invariably found. And ecchymoses are *not* rare in strangulation, or in hanging.

Saliva running in straight lines down the chin and chest, a common appearance in death from hanging, is not likely to be present in strangulation.

In three cases reported by Dr. Mackenzie, in none of them were the appearances in the air-cells of the lungs or about the skin of the face, neck and chest and conjunctiva mentioned by Tardieu found. In all these cases the eyes were closed. In none of them were muscles or other deep structures of the neck injured. In these cases the tongue was not swollen; in two it was protruded between the teeth and was bitten into but not through. In none were the fingers clenched.

Questions regarding Strangulation.

As in hanging, the chief medico-legal questions connected with death by strangulation, are: I. Was Death due to Strangulation? and II. Was the Strangulation Homicidal, Suicidal, or Accidental?

I. Was Death due to Strangulation ?

It may first be pointed out, that in very exceptional cases, death may occur by strangulation, without any mark being present on the neck. This may happen if a soft ligature has been used. It rarely, however, occurs, as even when a soft ligature is employed, much superfluous violence is commonly applied, and a distinct mark on the neck is usually present. If no marks of violence, either external or internal, are to be found on the neck, strangulation is very strongly, but not positively, contra-indicated. When strangulation has been effected by means other than the use of a ligature much violence is almost always used—often to other parts of the body as well as the neck—and there is seldom any difficulty in arriving at a conclusion as to the cause of death. Here, however, it must be remarked, that in very exceptional cases of death from natural causes, finger-marks may be found on the neck, accompanied by the *post mortem* appearances of death from asphyxia. An individual dying from asphyxia the result of disease, *e.g.* epilepsy, may, in his struggles for breath, by clutching at his throat, produce such marks. Hence, if the only marks of violence present on the body are slight finger-marks on the neck, a guarded opinion must be given as to the cause of death.

Case—Strangulation (? Suicidal). finger marks on the neck probably caused by deceased himself—A man was found dead in the house of a prostitute, who had been his mistress for three years. Deceased's cousin was sleeping in the same house with another prostitute, and was called early in the morning by deceased's mistress, who appeared to be much alarmed at his (deceased's) condition. The cousin found him apparently dying, and removed him to his own house. A *post mortem* examination

of the murder. It, however, appeared that deceased had been subject to epileptic fits, and many of the circumstances of the case being strongly against the supposition of homicide, the High Court reversed the conviction, holding that the marks on the throat might have been produced by deceased himself—*Chivers, Med Jur*, p. 550

Ligature mark on the neck, corresponding in external appearance to a strangulation mark, cannot of itself be taken as evidence of death by strangulation. Such a mark may be the result of the application of a ligature to the neck after death, or have been accidentally produced by the pressure of a tight fitting article of dress, or be the result of putrefactive swelling against a string tied loosely round the neck. In the

last two cases, however, injury to the underlying soft parts, common in strangulation, is not likely to be found. Hence, even when a ligature mark is found on the neck, corresponding in appearance to a strangulation mark, to establish the fact that death was due to strangulation, requires proof that the pressure of such ligature was the cause of death. Such proof may be afforded by the presence of the general *post mortem* appearances of death by strangulation. It must, however, be recollected that in hanging, as well as in strangulation by a ligature, death is due to the pressure of a ligature on the neck. Further, that in hanging the presumption is always in favour of suicide, while in strangulation it is in favour of homicide. Hence, in all cases of death from pressure of a ligature on the neck, all appearances indicating the cause of death to be hanging, rather than strangulation, or *vice versâ*, should be most carefully noted.

II. Was the Strangulation Homicidal, Suicidal, or Accidental?

Accidental cases are rare a few, however, are on record.

Case—Accidental strangulation.—Elizabeth Kenchan, an extremely dissipated, drunken, and disorderly woman, went to bed intoxicated with her bonnet on, and in the morning was found strangled in its strings. She had fallen out of bed, her bonnet became fixed between the bedstead and the wall, and she, being too drunk to loosen the strings, was strangled.—Guy, *For Med*, p 262.

Case—Accidental strangulation.—A man was carried to bed very drunk, and left there with his clothes on. It was supposed that afterwards he had got up so far as to lean over the front of his bed to vomit, with his hands pressed on the pit of his stomach, as he was found dead in this posture in the morning. His neckerchief was so tight around his neck that the contraction thus caused would have sufficed to produce

Ogston, *Med. Jur. Lect.*, p. 543.

Case.

the follo
her back
neck abo
the baske

raised the strap which had firmly compressed the windpipe.—Taylor, *Med. Jur.*, II, p. 67.

Suicidal cases of strangulation by a ligature are sometimes met with. To effect suicide in this way requires the employment of some means whereby the ligature is kept tight, independently of any muscular effort on the part of the suicide; so

that relaxation may not occur when insensibility supervenes. This end may be arrived at in various ways, *eg* by simply once round the neck; or, by to the foot, or to the wrists e is tightened when the arms are extended; or to some fixed object. Or, it may be arrived at by twisting a stick in the tied ligature, and securing the end of the stick; or by simply knotting the ligature. As regards this last method, it may be noted that the presence of more than one knot raises a suspicion of homicide; two knots have, however, occasionally been found in suicidal cases; more than two knots very strongly indicates homicide.

Homicidal cases.—Just as in hanging the presumption is always in favour of suicide, so in strangulation the presumption is in favour of homicide. Homicide is very strongly indicated, (a) when a ligature has been employed, by the absence of evidence indicating the use of some means for the purpose of keeping it tight after insensibility has occurred; (b) by the presence of signs indicating the application of much violence to the neck or to other parts of the body, and (c) when the strangulation has been effected by means other than the use of a ligature. Obviously homicide also is almost conclusively indicated if the hands are found tied together in such a way as to show that they could not have been so secured by the individual himself.

Case—Homicidal strangulation.—On April 4, 1898, Shaikh Haru left his home in good health, and the same evening his body was found tied up in a box, and Mihir Ali, of the Doveton Institution, was suspected of the crime. At the *post mortem* examination, made on the day of the death, the body was found tied by means of three cords, one made of jute, another of hemp, and a third of cotton. Thighs flexed on the abdomen, the legs on the thighs, the knees resting on the left side,

part of the neck, then downwards along the right arm to the right wrist, where it was tied to a narrow hempen cord. The hempen cord was $\frac{1}{2}$ of an inch in diameter, at its commencement it was double,

thigh, and was tied here to a part of the same cord, where it was turned backwards round the lumbar region. The third cord was made of soft

3 inches long and $\frac{1}{2}$ of an inch broad on the right cheek extended outwards from the right angle of the mouth. The abrasions of the lips and abrasion at the right angle of the mouth and on the right cheek had the appearance as if a gag had been applied to the mouth. The other signs of strangulation were present. **OPINION** that the deceased died from asphyxia, due to strangulation. **Mihir Ali** was found guilty of murder, and sentenced to be hanged, but his sentence was commuted by the Government to transportation for life.—*Dr. Coull Mackenzie, Ind. Med. Gaz., 1888, p. 232, etc.*

Case—Homicidal strangulation.—A *ghasami*, or thatcher, named Gopal Bairagi, eloped from his native village in the Burbhum district with a young woman named Bow, and the pair came to Calcutta and lived as husband and quarrelled. On the night of the next morning the woman covered with a quilt and a gunny bag, her mouth gagged with a piece of cloth, and a coir rope tied tightly round her neck. The body, examined on the 9th July, showed a mark of a cord round the neck immediately below the thyroid cartilage and a contusion of the left eyeball. A piece of cord was twisted twice tightly round the mouth and a double cord made of two twists of thin coir rope tied tightly across the middle of the neck. The skin beneath this cord was parchment-like. There was no extravasation of blood beneath the skin or into the muscles of the neck, nor injury to the muscles of the neck or to the wind-pipe. **OPINION** that the deceased died from asphyxia due to strangulation. , where
tied, as
only of

Suffocation.

Under 'Suffocation' are included all cases of asphyxia (drowning excepted) caused by violent means other than direct pressure on the wind-pipe; as for example—(1) By closing the mouth and nostrils; (2) by pressure on the chest, (3) by blocking of the lumen of the glottis or air tubes; and (4) by an atmosphere deficient in oxygen.

1. Closing the mouth and nostrils.—This may be (a) Homicidal, as in cases of infanticide effected by closing the mouth and nostrils with the hand. The mouth and nostrils in homicidal cases also may be closed by plasters applied to the face; this was the way in which the resurrection men, Burke and Hare, murdered their victims in Edinburgh. Burke, after conviction, confessed to sixteen murders effected in this

way in a few months. Again, soft pillows may be employed, as in the case of the two princes murdered in the Tower of London. (b) *Accidental*, as in cases where children are accidentally smothered by their *mothers overlaying* the infants in bed. (c) *Suicidal*.—Cases of suicide effected in this way are extremely rare. Talyor, however, mentions a case of a woman who is reported to have committed suicide by simply leaning with her mouth and nostrils pressed against the bedclothes.

2 Pressure on the chest.—Suffocation caused in this way is generally accidental, usually occurring from either accidental smothering by burial under the *debris* of fallen buildings, earth, etc., or pressure in a crowd, as in the case which occurred in Paris in 1837, in which twenty-three persons were suffocated in this way in a crowd in one of the streets. A case also is recorded of a man who, while a plaster cast of his trunk was being taken, was nearly killed by the pressure on his chest of the solidifying plaster. Homicidal cases are sometimes met with in India. In homicidal cases, if the victim is an adult, and was not first rendered insensible, or was not a consenting party, probably several persons will be found to have been concerned in the murder. Often great violence is used, sometimes causing symmetrical, or nearly symmetrical, fractures of the ribs (see p. 122). In children great violence may be employed, sufficient, in fact, to cause extensive injury to the lungs without fracture of the ribs. Under the head of homicidal suffocation by pressure on the chest may also be mentioned (1) the burial alive of widows with their husbands' body, a custom formerly prevailing, to a certain extent, in India, and (2) the *samādhi* or burial alive of lepers—often with the consent or at the entreaty of the victim—cases of which used formerly to be not infrequently met with in India. Suicidal suffocation by pressure on the chest is hardly possible.

3 Closure of the glottis.—Suffocation thus caused often occurs accidentally from the impaction of foreign bodies—masses of food, for example—in the throat or air passage—often by pieces of food during an inspiratory act whilst vomiting especially if drunk or under the influence of chloroform, or by swallowing false teeth, etc., or from spasm of the glottis, the result of disease or of the inhalation of irritant or irrespirable gases. Powell reports a case of the impaction of a round worm in larynx. Suicidal closure of the glottis effected by forcing fingers, etc., etc., into the fauces is sometimes met with. H.

are rare in adults. Children, however, are sometimes murdered by filling their mouths with mud or other soft material.

4. **Deficient Oxygen**, such as the fumes of wine or beer vats, or bursting of the carbonic acid pipes in a refrigerator.

Post mortem appearances in death from suffocation.

1. **Appearances of asphyxia.**—Cases, however, have occurred of undoubted death from suffocation, where most of the *post mortem* appearances of asphyxia were absent. On this point Christison, in the case of the woman Campbell, murdered by Burke the resurrectionist, remarked, "the conviction in the public mind that a well-informed medical man should always be able to detect death by suffocation, simply by an inspection of the body, and without a knowledge of collateral circumstances, is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly marked appearances in every case of death from suffocation. That such appearances are very far from being always present, ought to be distinctly understood by every medical man."

2. **Punctiform sub-pleural ecchymoses**, or 'Tardieu's spots' (p. 221 and below), are usually present in cases of suffocation. Powell reports two large apoplectic effusions in a child whose death was caused by plugging the larynx with a rag.

3. **Appearances of violence** sufficient to cause suffocation, *eg.* marks of violence on the chest, marks indicating the application of manual pressure, or of plasters over the mouth and nostrils, foreign bodies impacted in the throat, etc. Cases, however, of death from suffocation by violence may occur, and no appearance of this class be present.

Questions regarding Suffocation.

As in hanging and strangulation, these are:—I. Was Death due to Suffocation? and II. Was the Suffocation Accidental, Suicidal, or Homicidal?

I.—Was Death due to Suffocation?

The chief points bearing on this question are:—

1. The signs of asphyxia may be nearly absent, and yet

death may have been caused by suffocation (see Christison's remarks just quoted).

2. The signs of asphyxia may be present, and those of drowning, hanging, and strangulation absent, and yet death may not have been the result of suffocation by violence, but may have been due to asphyxia, the result of disease, or poison, *e.g.* epilepsy, tetanus, or strychnia poisoning. Hence, in cases of alleged suffocation by violence, much depends on the presence or absence of signs indicating the employment of violence, such as would produce suffocation. If these are absent, no positive opinion can be given, from the *post mortem* examination alone, as to the cause of death.

3. Tardieu's spots (p. 204). If these are numerous, well defined and limited in size, on the lungs and thymus gland they contra-indicate strangulation, and indicate suffocation to be the cause of death. Their presence, however, is consistent with death from causes other than suffocation. They have been met with in the bodies of adults after death from drowning, hanging, strangulation, scarlatina, heart-disease, apoplexy, pneumonia, and relapsing fever. They are almost the rule in plague. They are also found in the bodies of still-born, and even unborn, infants. Further, their absence does not, at any rate in the case of adults, conclusively contra-indicate suffocation. Ogston failed to find them in nine cases of death from suffocation in adults.

II.—Was the Suffocation Accidental, Suicidal, or Homicidal?

1. If the deceased is an adult, the presumption is always in favour of accident. Curious accidents leading to suffocation by closure of the glottis sometimes occur. Suicidal cases are rare, but are sometimes met with, *e.g.* the case of suicide by closure of the mouth and nostrils already referred to above, p. 219. A case also is reported in which a prisoner committed suicide by stuffing his mouth with rags, another in which a young woman suffocated herself by stuffing a large ball of hay into her throat, and another of a young woman who committed suicide by shutting herself up in a trunk. Homicidal cases are not often met with. In a homicidal case, unless the victim was suffocated while insensible, marks showing the employment of much violence will probably be found.

Case.—Accidental suffocation by plums.—Dr. Mackenzie relates that of a native female child of about four years of age, who, while

not shrunken. The lungs, the liver, the spleen, the kidneys, and the

faces and half-digested green plums. No bones were fractured. Opinion: That the child died from suffocation owing to the half-digested green plums passing into the air passages during a deep inspiration while in the act of vomiting.—*Ind. Med. Gaz.*, 1890, p. 295

Case.—Accidental suffocation by meat.—A European sailor, J. K., who had been drinking heavily, while eating a mutton chop began to vomit and suddenly became insensible. He was removed to hospital, but on arrival was dead. Post mortem a piece of the chop, $3\frac{1}{2}'' \times 1''$, was found firmly wedged into the entrance of the larynx.

Case.—Suffocation in a Chest.—A sweeper in the Byculla Club, Bombay, in the habit of sleeping in a wooden trunk, was found dead of suffocation in 1916. The lid, which was almost vertical when open, had accidentally fallen down and the body had become fastened.—*Prof. Powell's Reports*, 1917.

Case.—Accidental suffocation.—"In 1850, Dr. Whyte reported the case of a strong Madras water carrier into whose mouth a fish had

one side was posterior to the velum, and opened out on any attempt being made to withdraw the fish. The operation of oesophagotomy was com-

Case. **Accidental suffocation.** 'A private soldier, of 28, was discovered at night by the man lying next to him to be breathing loudly and with great difficulty, as if there were some obstruction about the lower part of the trachea. He was at once removed to the dispensary, where he died in about fifteen minutes. Several small pieces of potato were found in both bronchial tubes, where these subdivided into small branches. There was great oedema of the glottis, no doubt from the irritation caused by a foreign body. The deceased had drunk some beer and also rum in the course of the evening, before retiring to rest. He had been sick, and had vomited while in bed.'—*Chevers, Med. Jour.*, p. 618.

2. If the deceased is a child or infant suicide is, of course, contra-indicated, and the question lies between accident and homicide. Accidental cases often arise from **overlaying**, or from accident during birth (see 'Infanticide').

Fatal overlaying of infants by parents in bed through carelessness occurs chiefly amongst the poor, and is rare after nine years of age, as the child is then strong enough to extricate itself. In suspected overlaying the death may sometimes be due to fatal teething or cerebral convulsions during the night. In addition to marks of suffocation, marks of pressure on the body or face should be looked for, *e.g.* a flattened nose. Cases are reported by Dr. Westcott, coroner of N.E. London (*Trans. Med. Leg. Soc.*, 1. 1903, 44), of overlaying of infants by the domestic cat and by the infant burying its face in a pillow.

Homicidal suffocation is sometimes met with in children, and frequently met with in infants, by stuffing the mouth with rags, or filling it with cowdung or dirt, these being common modes of infanticide in India.

Case.—**Homicidal suffocation.**—A lad from thirteen to fifteen years of age was sentenced, at Agra, to transportation for life for having robbed a woman, and having filled her mouth with cowdung, so that death had resulted from the suffocation of the deceased.

Case.—A girl aged about twelve. Body far advanced in decomposition; no marks of violence externally, but on cutting into the skin of the chest, extensive bruises and bloody effusions were found over the whole front aspect of the ribs. The ribs were not fractured. The right lung was

natural, but the left had been most severely injured by compression and had become a jelly-like mass. The girl had probably been thrown down, and then had her chest compressed by the weight of her assailant's body. —Dr McReddie, in *McLeod's Beng. Med. Leg. Rep.*, 1868-69, p. 36.

Drowning.

This mode of death from asphyxia is by submersion of the mouth and nostrils under water or other fluid, so that access of air to the lungs is cut off. This form of asphyxial death differs from the other forms, in that water or other submersing fluid is drawn into the lungs during attempts at respiration.

Causes.—Accidental cases are common among the seafaring population of the coast and inland, especially among females, from falls into wells and tanks.

Suicidal cases are also common in India. In the Madras and Bombay presidencies, over three-fourths of the female and nearly one-half of the male, suicides drown themselves. In European countries also, drowning is a mode of suicide often selected, ranking, as a rule, second in order of frequency. In Dr. Mackenzie's 305 cases of drowning at Calcutta, only 2.62 per cent were suicidal, the reasons assigned being family disputes, insanity, and bodily disease. Homicidal cases are rare, but are sometimes met with in India. Dr. Mackenzie had only one such out of 305 cases.

Mode of Drowning.—When a person falls into water he sinks, but usually, if not stunned, rises again to the surface, probably by the movements of his limbs, and tries to breathe, in which case death occurs by asphyxia. In his struggle, he takes in some water, which striking the glottis causes cough and forcible expiratory efforts, and the raising of a portion of his body out of the water, causing him to sink a second time. He may again rise to the surface by the movements of his limbs, again struggle, and sink. Ultimately, in consequence of the expulsion of air from the lungs, and the specific gravity of the body being greater than that of water in the proportion of 1.08 to 1, the body ceases to rise. The subjective sensations are said by the resuscitated to be mental confusion followed by pleasing dreams. Where the person sinks at once and does not rise again during life, death is due to 'inhibition' or some precedent condition, *e.g.* syncope, epilepsy, etc.¹

¹ F. Crookshank, *Trans. Med. Leg. Soc.*, 1910, 13-21.

Submersion of the whole body is not necessary for drowning, as drunkards, epileptics, and children have been drowned in shallow puddles or vessels containing only a few inches of water.

Case—Drowning in shallow water.—Dr. A. Powell gives these two cases.—*Patu in*, at 20, liable to epileptic fits, for which he had been under treatment at intervals for two years, went to work in some muddy rice land on 14th May, 1890. An hour later he was found dead, lying with his face downwards in a shallow pool. The water was so shallow that only his mouth, nose, and the right side of his face were immersed, the left eye and side of face being above the surface. The rest of his
Post mortem—The
 given water

On August 23, 1890, she was found dead, face downwards in an almost dry drain. I measured the depth of the water at once and found the maximum for some distance to be 2 inches, except a depression of 3½ inches where her head had lain. *Post mortem*.—Air passages contained sand and muddy waters with a few blades of grass; skin of face soddened a *la blanchisseuse*, elsewhere *cutis anserina* marked. Uterus contained an eight months' fetus.

For other two cases see Appendix.

Mode of death.—In the great majority of cases death is due to asphyxia. Almost all the balance is due to inhibition or syncope. Apoplexy, if by this is meant cerebral hæmorrhage, is most rare, and if prominent would be the cause of death and not drowning. Excitement, whether due to a struggle against drowning or against an enemy in a fight, or trying to catch a train, will make a diseased artery give way and cause apoplexy.

In Dr. Mackenzie's 305 cases, 297 or 97·37 per cent. persons died from asphyxia; 1 or 0·32 per cent. from syncope; 1 or 0·32 per cent. from asphyxia and apoplexy, and in 6 or 1·96 per cent. the mode of death could not be ascertained, on account of the bodies being in a very advanced state of putrefaction.

Period at which death takes place.—This varies with the mode of death. It is instantaneous if from shock, rapid if from pure asphyxia, less rapid if from a combination of asphyxia with syncope or cerebral congestion. When death occurs from pure asphyxia, asphyxia commences as an outside limit after two minutes' complete submersion, and death takes place within five minutes. Recovery is rare after five minutes' complete submersion.

The longest record dive under water is 4 minutes 45½ seconds by Miss E. Wallenda in a tank at the Alhambra Music Hall, as tested by expert timekeepers.—*Whitaker's Almanack*.

Treatment should, however, be persevered with, until it is certain that death has taken place, (a) because in exceptional cases animation has been restored after more than five minutes' complete submersion, (b) because the submersion, although alleged to have been complete, may not have been so, and (c) because by persevering treatment, individuals have been recovered, who have shown no signs of animation for several hours; in one case of recovery it is said that there were no signs of animation for 8½ hours

Period at which dead body floats.—The body eventually comes to the surface, if not entangled, when putrefactive gases make it sufficiently light to float. The length of time for this varies with the temperature of the air, water, the sex, etc. Fat bodies float sooner than thin. In hot weather a body may float within 24 hours after drowning, but it is seldom possible to estimate from the bodies the length of time since death.

In the Hughli river at Calcutta Dr. Mackenzie found that if there was no obstacle to impede the rising of bodies they generally floated in the hot and rainy season within 24 hours of the immersion, and in the cold season in from two to three days¹. In Dr Mackenzie's 805 cases, in 188 or 45.28 per cent putrefaction was present, in 5 or 1.63 per cent. the bodies were sponified, in 124 or 40.65 per cent the bodies were fresh; and in the remaining 39 or 12.45 per cent no note was made as to their condition

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d 92 lbs, so
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dead-weight
body, when

found, was lying horizontally on the surface of the water on its side. The water was from ten to twelve feet in depth, and the specific gravity of the stone was 2.7. This case is of interest, as showing the extreme buoyancy of a decomposed body in water, and the rapidity with which gases can be generated. The murder occurred in September, 1883.—Gribble, *Med. Jur.*, p. 99.

Treatment of Apparently Drowned Persons.

Attempts at resuscitation should be commenced at once. First get rid of any water in the mouth, and upper air passages,

¹ *Ind. Med. Gaz.*, 1889, 131. See also Art. by Prof. Powell in *I. M. G.*, 1904.

etc., by placing the body for a few seconds, face down, with the head a little lower than the feet, keeping the mouth open, and the tongue drawn forwards. Next turn the body on the back, as quickly as possible, strip it, rub it dry, and apply warmth to the surface, and weak ammonia or snuff may be held to the nostrils by some other person. If respiration is not restored, commence artificial respiration immediately.

Artificial respiration.—The best and easiest method of is safer, methods of d (supino, followed by bringing these back to the side of the chest, and pressure on



FIG 21.—Schæfer's Mode of resuscitating the Apparently Drowned

the chest) In the Schæfer method,¹ amongst other advantages, the face of the person being placed downwards the tongue falls downwards and out of the way of the wind-pipe whilst water and mucus run out, and the muscular exertion required by the operator is very much less than in the other methods. Its mode of application will be seen from the illustration.

Directions.—Instantly on removal from the water place the patient face downwards on the ground with a rolled-up coat under the lower part of the chest so that the head hangs down, and the patient's arms bent and placed under his forehead to keep nose and mouth clear of the ground. The operator puts himself athwart the patient, or kneels by his side facing his head. Then place your hands flat over the lower part of the back (lowest ribs), one on each side, and gradually throw the weight of your body forward on them so as to produce firm pressure, which must

¹ E. A. Schæfer, in *Medico-Chirurg Trans.*, 1904.

not be violent, on the patient's chest. By this means the air (and water, if there is any) is driven out of the patient's lungs. Immediately thereafter raise your body slowly so as to remove the pressure, but leaving your hands in position. Repeat this forward and backward movement

or until the natural respirations are resumed. If they are resumed and, as sometimes happens, again tend to fail, the process of artificial respiration must be again resorted to as before. Whilst one person is carrying

has recommenced. Hypodermic injections of atropine sulphate ($\frac{1}{100}$ th to $\frac{1}{20}$ th grain), and of supra-renal extract (either as adrenalin chloride or in any other form) may be used to assist recovery.

When spontaneous breathing returns, apply heat by water-bath or friction, and when swallowing returns give a little brandy and water. This treatment should be persisted in for several hours—flushing and convulsive twitchings of face and gasping indicate returning breathing. The prospect of resuscitation is better when the cause of apparent death is inhibition than in asphyxia.

Questions regarding Drowning.

The chief medico-legal questions connected with drowning, which must be kept in view when making the examination, are:—(1) Is life extinct? (2) The *manner* and cause of death. What is the probable cause of death, was it Drowning, or some other cause operating before immersion? and (3) 'Was the Drowning Accidental, Suicidal, or Homicidal? The first question is answered under the 'Signs of Death.'

II. Was Death due to Drowning or to some other cause operating before immersion?

Signs of drowning in body.—The external signs will vary according to length of time the body has been submerged. As in 87.5 per cent. of cases of death from drowning, the mode of death is asphyxia, pure or mixed, the *post mortem* appearances of death from asphyxia will usually, but not invariably, be found. Thus usually the right side of the heart will be full, and the left side empty, and the lungs and venous system

engorged. Great congestion of the lungs, especially if accompanied by sub-pleural ecchymosis, indicates that the struggle for life has been great. Whether, however, the *post mortem* appearances of apnoea are present or not, other appearances indicative of death from drowning must be searched for, because (a) asphyxia, if present, may have been the result of causes other than drowning, and (b) the mode of death may not have been apnoea, and yet death may be due to drowning.

Post mortem signs other than those of asphyxia which indicate death by drowning are as follows:—

Externally.

1. **Froth in the mouth and nostrils.**—This froth, like fine 'shaving lather,' although usually present in death from drowning, disappears soon after the body is removed from the water. It is often also present in death from causes other than drowning, e.g. in epilepsy, and in cases of death from asphyxia not due to drowning.

2. **Cutis anserina**, or goose-skin, if present, indicates that immersion took place either during life or shortly after death; no conclusion can however, be drawn from the absence of this appearance. Powell points out that it is due to contraction of the erector muscles of the hairs and that it disappears with *rigor mortis*, which is usually early.

3. **Retraction of the penis.**—This is the result of cold, terror and arduous struggling, and is frequently found in cases of drowning, it may be absent in tropical waters; the colder the water, the more marked is the shrinking.

4. **Sand, mud, weeds, sticks, etc.**, grasped in the hands or sticking under the nails, are evidence of struggles in the water during life, and hence presumptive evidence in favour of death having been caused by drowning, abrasions on skin, especially hands.

Internally.

1. **Water in the stomach**, especially if this contains matters such as

Powell found water in the stomach in about 60 per cent. of cases of drowning

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due to drowning

In conclusion, it must be remembered that in many cases where death is undoubtedly due to drowning, *post mortem* evidence may be indefinite or altogether absent. In such cases, it is the duty of the pathologist to say he has found no evidence, or no definite evidence of drowning, but that such finding is consistent with death from drowning. In many such cases where no lay evidence is forthcoming juries usually give the verdict of "Found Drowned." A more logical verdict would be "Found dead in the water." As decomposition advances *cutis asserina*, froth in the nostrils, froth and water in the lungs, and water in the stomach successively disappear. The penis and scrotum become ballooned with emphysema. Hence, in all cases of suspected drowning, the *post mortem* examination should be held at the earliest possible opportunity.

It should be noted that the *post mortem* appearances of death by drowning may be altogether absent, and yet drowning may have been the cause of death. In such case the absence of appearances indicative of death from a cause other than drowning, *e.g.* violence, poison, or disease, must be ascertained by careful search.

III. Was the Drowning Accidental, Suicidal, or Homicidal?

Death from drowning is, as above noted, usually accidental, more seldom suicidal, and rarely homicidal, except in infants. The fact, however, of the body being found in water does not necessarily imply death from drowning, as the person may have been murdered first and afterwards thrown into the water. Thus the body found in water should always first be examined for marks of violence. On the other hand, some suicides inflict wounds on themselves before drowning and have even tied their feet together and weighted their bodies with stones, etc. Valuable indication of insanity or otherwise may be obtained from papers or notes in the clothing. (N.B.—Sodden papers should be unfolded in water and *not* first of all dried.) Sometimes no indications are afforded as to whether accidental or suicidal.

1. **Marks of violence on the body.**—All cuts, bruises, or abrasions should be especially examined, as the presence of inflammatory action indicates an injury received sometime

before death. Very often such marks are due to accidental injury at the time of immersion, or, but less often, to injury after immersion. Hence, in a case of death from drowning such marks do not indicate homicide, unless from their nature or from the circumstances of the case, the possibility is excluded of their being due to: (a) injuries received at the time of immersion, owing to the body striking in its fall against some hard object, or if the fall had been from a great height against the surface of the water. Bodies found in wells frequently exhibit severe injuries caused in the first of these two ways; and fracture and dislocation of the cervical vertebrae have resulted from the head striking forcibly against the bottom of a shallow bath. Again, a case is recorded in which dislocation of both arms backwards was caused by the body after falling from a great height striking the surface of the water with the arms outstretched. (b) Injuries received after immersion, during life or after death, *e.g.* a case is reported where a mark of a ligature on the neck was produced by the string of a cloak getting tightly drawn round the neck during the struggles of the drowning person, and another where fracture of one of the cervical vertebrae was caused by the muscular effort of throwing the head violently back on contact of the body with the water. Obviously also severe injuries may result from the body during life or after death being forcibly dashed against some hard object, *e.g.* a rock or wall, or the pier of a bridge, or from the bites of animals.

2. **Ligatures** are found round the hands or feet, or weights are found attached to the body. In such cases accident is contra-indicated. If the ligatures are found tied in such a way that the individual himself could not have tied them (but not unless this is the case) suicide also is contra-indicated.

3. **The body is found in shallow water.**—In this case accident is contra-indicated, unless the individual was intoxicated or insensible at the time of immersion or a child in a tub of water. Suicide is not contra-indicated, as cases are known of individuals drowning themselves in water only a few inches deep. If drowning in shallow water is homicidal, marks of violence due to the force employed in holding the victim under water will usually be present. Here it may be mentioned that in some parts of India a form of ordeal to which women suspected of witchcraft are in some instances subjected, is holding the head under water during the time an arrow is shot from a bow and brought back to the place from which it was shot.¹

¹ Gribble, *Med Jur*, p. 154

Case—Weeds in mouth indicate site of drowning.—The body of a child was found in a tank at a considerable distance from his own house, and suspicion was naturally excited that he had been conveyed thither and made away with. Dissection afforded clear evidence of death from

portions of

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boy's body had been found by a woman in a tank near his home, in which the weed, lodged in the air passages, grew abundantly. This female had conveyed the corpse to the more distant tank, which belonged to a person against whom she bore a grudge.—*Chevers, Med. Jur.*

For other cases see Appendix VII.

CHAPTER VIII.

BURNS AND SCALDS.

'BURNS' are injuries produced by the application of flame or heated substances to the body, while 'scalds' result from the application of steam or hot liquid at or near its boiling-point. The effects of burns and scalds are essentially the same. Injuries caused by the application to the surface of the body of corrosive substances, i.e. such substances as cause chemical destruction of the tissues, may also, for medico-legal purposes, be classed as burns. The chief medico-legal questions connected with burns and scalds are:—I. Is the injury a burn or scald, and if so, how was it caused? II. Was the injury inflicted during life? III. Was the injury the result of accident, self-inflicted, or inflicted by another? and IV. What results followed, or are likely to follow, from the injury?

I.—Is the Injury a Burn, or Scald, and if so, how was it caused?

A conclusion arrived at in regard to this question may be of importance

1. By ss. 324 and 326 of the Indian Penal Code, the causing of hurt, or grievous hurt, by certain specified means, is made an offence punishable more severely than when such means have not been used. Among the means specified in these two sections are not only what may be called lethal weapons (see pp 117 *et seq*), but also "fire or any heated substance," or any "corrosive substance," or "explosive substance."

2. It may affect the question of the guilt or innocence of an accused person. In this respect it may be of much importance to determine, if possible, the precise means whereby the injury, if a burn, was produced, e.g. whether produced by the application of a particular heated solid, or of a heated liquid, or by the application of a particular corrosive substance.

Degrees of burns.—For medico-legal purposes, injuries caused by the application of heated substances to the body may be divided into: (1) Burns producing mere redness. (2) Burns causing mere vesication. (3) Burns causing the death of the part injured. And to these three classes may be

added a fourth, viz. (4) burns caused by the external application of corrosive substances.

(1) Burns producing mere redness are usually caused by the momentary application to the part of a hot solid, or of a fluid at a temperature several degrees below the superficial inflammation, & Burns of this class may be irritants to the skin

(2) Burns causing vesication are produced by the application of liquids

heat, and no permanent marks are left. In severe cases, or in unhealthy subjects, suppurating of the vesicles may occur, followed by ulcers, leaving permanent cicatrices. Burns of this second class may be simulated by the application to the skin of various strong irritants, *e.g.* cantharides and tartar emetic. In badly nourished persons vesication of the skin, resembling a burn, may occur without the application of heat¹

(3) Burns causing the death of the part injured are produced by pro-

4th degrees); or the underlying soft parts, as well as the skin, may be affected (*Dupuytren's 5th degree*); or an entire limb, bones and all, may be destroyed (*Dupuytren's 6th degree*). Burns of this class often leave sores difficult to heal, or so large in extent as to require the performance of an amputation. They leave permanent cicatrices, which frequently contract considerably, causing by their contraction considerable deformity, or impairment of the use of members or joints. If a burn of this class has been caused by the application of a heated solid, the form of the solid employed may frequently be inferred from the shape of the burn. In burns produced by highly heated solids or liquids, the skin, if moist, may be brought into contact for a short time with substances at a high temperature, *e.g.* red-hot solids or melted metals, without a burn being produced. This depends on the assumption of the spheroidal state by the moisture on the surface of the skin, and as a high temperature is necessary for the production of this spheroidal state, the temperature of the substance brought into contact with the skin must be high, otherwise a burn will be produced.

(4) Burns caused by the application of corrosive substances to the body seldom extend deeper than the true skin. Vesication does not

may frequently be inferred from the colour of the marks on the skin, or definitely ascertained by chemical examination of the stained portions of clothing (see 'Corrosive Poisons,' Chap. XXII.).

¹ Guy's For. Med., p. 203

II.—Was the Injury inflicted during Life ?

This question sometimes arises, *e.g.* in cases where, in order to conceal a murder, an attempt is made to burn the body of the murdered person. The chief appearances whereby burns inflicted during life may be distinguished from *post mortem* burns are presence of (1) signs of inflammation ; (2) a line of redness ; and (3) vesication.

(1) **Signs of inflammation** and reparative action, such as the presence of granulations or pus on the injured surface, indicate that the injury was inflicted some considerable time before death. The absence of such signs, of course, does not indicate that the injury was inflicted after death.

(2) **A line of redness.**—If a burn is inflicted during life, in the great majority of cases, a line of redness almost immediately forms round the injured surface. This line of redness, although it may be surrounded externally by a blush, disappearing on pressure or after death, does not itself disappear on pressure, and remains visible after death has taken place. The presence of a line of redness possessing the above characters is almost certain evidence that the burn was inflicted during life, and conclusive evidence that it was inflicted during life, or within ten minutes after death. Its absence, however, is not positive evidence that the burn was inflicted after death.

(3) **Vesication.**—Here it is convenient to distinguish between what may be called respectively true and false vesication. In true vesication the vesicles contain serum very rich in albumen. In false vesication the vesicles either contain air only, or (especially in dropsical bodies) a small quantity of serum, in which traces only of albumen are present. The presence of true vesication, as the result of a burn, is proof that the injury was inflicted during life. The presence of false vesication, as the result of a burn, shows that the injury was inflicted after death. The entire absence of all vesication is quite consistent with the supposition that the burn was inflicted during life, as the fire continuing after death may dry up the vesicles.

III — Was the Injury the result of accident, self-inflicted, or inflicted by another ?

Accidental cases are so common that the presumption is always in favour of accident. Accidental cases may arise from

an individual's clothes catching fire, or having heated liquid spilt accidentally over him: or a petroleum lamp breaks, and its oil catches fire and falls on him. Sometimes persons in a state of intoxication fall asleep near a fire and are accidentally burnt to death, and there are also the rare cases of so-called spontaneous combustion. In the majority of accidental cases, examination of the body throws little or no light on the question whether the injury was or was not the result of accident. It may, however, be noted that burns on several distinct and separate portions of the body contra-indicates accident, whilst the discovery of the burned body at the spot where ignition first took place is consistent with the supposition of accident, if the individual was narcotized or insensible at the time ignition occurred. Marks of violence present on the body do not necessarily contra-indicate accident. Such marks may, for example, be due to injuries received prior to, or at the time of, accidental ignition. It must be borne in mind also that sometimes marks closely resembling wounds are produced as the result of a burn.

Suicidal cases are becoming more common as *sati* in India of late (1917) is becoming more popular

Burns are sometimes self-inflicted in order to support a false charge. Where this is suspected, the question whether or no the injuries correspond in appearance to the alleged method of production must be carefully considered (see *Case* below).

Case.—False charge of burning.—"In March, 1865, the assistant magistrate of Howrah sent me a girl about ten years old, for my opinion as to how certain marks on her cheeks, arms, and back were caused. She asserted that they were burned with a hot *chillum* (tobacco-pipe), whereas the accused declared that they had been made with some paint. I found a large circular brown mark on either cheek, each of these marks had a clean and perfectly defined edge. The marks on the arms and back were parallel brown streaks, with clean edges, there was

It must be recollected that the application of the actual cautery, or of moxas, or of strong blistering agents, to the body, is a favourite method of treatment among *hakims* in India, and that false charges may be found on burns so produced. The presence also of such burns on a dead body

may give rise to an erroneous suspicion as to the cause of death.

Homicidal cases, and cases of the infliction of hurt, by burning, are not infrequent in India. Chevers mentions a number of cases, the means employed being, in many of them, the application of heated iron instruments, *e.g.* sickles or ladles or spoons, to the part. In other cases, placing the victim over a fire, applying a lighted torch or a piece of ignited charcoal or a heated pipe-bowl, or pouring heated oil on the body, or covering a portion of the body with tow or rags steeped in oil and setting fire thereto, were the means resorted to.

Case—**Homicidal scalding.**—Several *daruans* of the Bengal Paper Mills at Raiganj attacked a European assistant, Mr Ironside, and threw him into a hot-water tank on the 11th July, 1899. The surgeon of

up was that Mr. Ironside accidentally fell in the tank while running away from the natives, with whom he had quarrelled.

In several of Chevers' cases the victims were females, and the burns were inflicted on the pudenda, as a punishment for suspected adultery. In others the victims were children, the burns being inflicted as a punishment for trifling offences. Chevers also mentions numerous cases of the use by dacoits of torture by fire, for the purpose of extorting information from their victims, as to the place of concealment of money or valuables; and also cases in which thieves, or persons suspected of theft, have been tortured by burning, as a punishment, or in order to extort confession. Again, plunging the arm into boiling oil is a form of ordeal to which women suspected of witchcraft are subjected in some parts of India. Along with homicidal cases may be classed cases where an attempt is made to conceal a murder by burning the body of the murdered person. In such cases nothing but fragments of partially charred bones may be discovered (see *Case* below).

Case—**Supposed attempt to conceal murder by burning the body.**—In a case forwarded from Sakhar (Sindh) some fragments of partly burnt bones were sent for opinion as to whether the same were or were not fragments of human bones. Several of the fragments forwarded were clearly identified as fragments of the bones of an adult human being. A

where the double trail ended, and a return single trail began; at this place the fragments or bone sent for examination were found.—*Bombay Chemical Analyser's Report for 1883*, p. 9.

In other cases the soft part may be more or less entire, and then two questions obviously arise, viz. (a) Have the burns the character of *post mortem* or *ante-mortem* burns? and (b) Does examination of the body reveal a cause for death (or for the occurrence of insensibility) irrespective of the burns? The first of these questions has already been discussed (see *Quest. II.*). In regard to the second question, the only special point to be noted is, that, as already mentioned, injuries resembling to a certain extent wounds caused by mechanical violence may be produced on a body by the action of heat alone.

IV.—What Results followed, or are likely to follow, from the Injury?

For medico-legal purposes in India this question, as in the case of wounds (see p 168), becomes: Has the injury caused, or is it likely to cause, death; and if not, has it caused one or other of those forms of hurt which are by the law of India designated as 'grievous hurt'? In this regard note—

1. **Death** may occur from burns (1) Before reaction sets in, i.e. within forty-eight hours of the receipt of the injury, from (a) shock or collapse; or (b) coma, due to congestion of the brain, and serous effusion into the ventricles (this may be mistaken for opium poison). (2) After reaction has set in, from (c) various internal inflammations, e.g. pneumonia, bronchitis, pleurisy, enteritis. Enteritis with ulceration, followed by peritonitis, is a not infrequent cause of death from burning, especially in young people; (d) surgical complications connected with the injury, e.g. gangrene, erysipelas, tetanus, pyæmia, etc.; or (e) from exhaustion.

2. **The danger to life in burns** depends chiefly on (1) extent of surface injured.—Burns involving a great extent of surface are specially dangerous to life. "A burn involving two-thirds, or even one-half of the entire skin, may be regarded as certain to destroy life, and the same practically may be said

of a burn (if severe) involving one-third of the body" (Tidy): deep burns involving a limited portion of the body are not nearly so dangerous to life as burns involving a wide extent of surface. (2) *part burnt*.—Burns on the trunk are more dangerous to life than burns on the extremities, and death before reaction has set in is specially likely to occur in the case of burns involving a wide extent of surface on the trunk. (3) the depth of the burn, and (4) *age of the patient*.—Children, as a rule, bear burns badly, whilst old people bear them comparatively well (Tidy). **The most fatal period** after a burn is the first week. Erichsen found that in 54 per cent of fatal cases death occurred within four days, and in 66 per cent within eight days, after receipt of the injury.

3. **The post mortem signs of death from burns**.—The soft parts may be entirely destroyed, and it may be impossible from the *post mortem* appearances to form any opinion as to whether death was due to burning, or to some other cause operating before cremation of the body. If the soft parts are more or less entire, the *post mortem* appearances present may be. External, viz marks on the surface of the body, having the characters possessed by burns inflicted during life, and varying in appearance according to the length of time which has elapsed between receipt of the injury and death. If the body is roasted the limbs are usually contracted or flexed; be careful, therefore, in attempting to straighten the limbs, as the roasted skin may crack, and similar 'wounds' may have taken place before your arrival. **Internal**.—Perforating ulcers of the duodenum, resulting from inflammation of Brunner's glands, are common in cases of deaths from burns especially in young children (Curling). Peyer's patches, and the solitary glands generally, are often greatly inflamed and sometimes ulcerated (Tidy); (c) Congestion of various organs, *e.g.* the brain, lungs, liver, kidneys, etc.

In making a post mortem examination in a case of alleged death from burns, it must always be borne in mind that death (or insensibility) may have been produced by causes operating previously to the infliction of the burns. Hence, in cases of alleged death from burning, it is extremely important to note (a) Whether or not the burns possess the characters of burns inflicted during life, and (b) whether the examination of the body reveals any cause for the occurrence of death (or
and if wounds are present
appear to have been caused

Case.—Apparent wounds caused by burning.—A boy, *æt.* two, was brought to hospital severely burnt and died in three-quarters of an hour. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella, or knee-pan, where it became somewhat jagged, and making a sudden turn inwards, passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh, a little above the knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. In several places some small vessels containing blood were observed running across the fissures, these, being more tenacious than the fatty tissue, had not yielded with it. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose

4. 'Grievous hurt' may be caused by burns.—The injuries which, by s 320 of the Indian Penal Code, are designated as 'grievous hurt,' have already been enumerated. Burns are especially likely to cause the following forms of 'grievous hurt':—(a) Hurt "*which endangers life, or which causes the sufferer to be, during the space of twenty days, in severe bodily pain or unable to follow his ordinary pursuits*" It has before been noted that burns involving a wide extent of surface (especially of the trunk) are specially dangerous to life (b) If the burns are on the head or face, especially if the true skin is affected to any depth, "*permanent disfiguration of the head or face*" is likely to result. (c) "*Permanent privation of the sight of either eye*" is a not unfrequent result of the throwing of corrosive fluids, *e.g.* oil of vitriol, over the body. (d) "*Permanent impairment of the powers of*" a "*member or joint*" is specially likely to occur (from contraction of cicatrices) in the case of severe burns in the neighbourhood of joints.

Spontaneous Combustion.

The question whether the human body is hable to spontaneous combustion has arisen in the following way:—It is well known that in ordinary circumstances long exposure to a high temperature, and the expenditure of a considerable amount of fuel is required in order to

covered with a greasy, stinking soot, but although combustible, unburnt, indicating that the temperature of combustion has been comparatively low (see *Case*, p. 242).

In order to start the combustion of an inflammable substance, a portion of it—no matter how small—must be raised to a particular temperature. The temperature required varies with the substance. A

of heat by chemical action, such chemical action taking place either between the substance and the oxygen of the air, or, in a few cases, between two of the constituents of a mixture. The principal substances liable to spontaneous combustion are:—

1. **Certain simple bodies**—Phosphorus is the best known example of this class. This substance, in its ordinary condition, oxidizes in air

2. **Certain compound bodies** take fire at once on exposure to air, *e.g.* silicon hydride, liquid phosphide of hydrogen, and zinc ethyl. The presence of a small quantity of the vapour of liquid phosphide of hydrogen also, it may be remarked, confers the property of spontaneous inflammability on combustible gases.

3. **Certain mixtures of substances** are liable to spontaneous combustion from—(a) The occurrence of chemical action between the constituents of the mixture, *e.g.* phosphorus takes fire on being brought into contact with iodine. Many finely divided metals and paper moistened with turpentine take fire in chlorine. Turpentine takes fire if mixed with fuming nitric acid, etc. Probably the occasional spontaneous combustion of red fire (a mixture of sulphur, carbon, antimony sulphide, potassic chlorate, and strontium nitrate) is due to this cause. (b) The oxidation of one of the constituents of the mixture—The constituent undergoing oxidation may be an inorganic substance, *e.g.* a metallic sulphide. Some varieties of coal contain iron pyrites (sulphide of iron) in considerable quantity, and are liable to spontaneous combustion from heat developed

Cotton, wool, hemp, flax, jute, woody fibre, and lamp-black have all been known to catch fire spontaneously when moistened with linseed or other drying oils. Woody fibre moistened with turpentine has been known to catch fire from a similar action.

Organic matters moistened with water only, *e.g.* damp hay, cotton, tow, flax, coconut fibre, leaves, etc., are liable to become heated from oxidation. Spontaneous ignition of damp hay and cotton, and of damp oats and esparto grass, has been known to occur. It may also be

Case.—**Apparent wounds caused by burning.**—A boy, *et.* two, was brought to hospital severely burnt and died in three-quarters of an hour. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella, or knee-pan, where it became somewhat jagged, and making a sudden turn inwards, passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh, a little above the knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. In several places some small vessels containing blood were observed running across the fissures, these, being more tenacious than the fatty tissue, had not yielded with it. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of fire, and the irregular character and appearance of the fissures, Mr. Curling considered them to have been occasioned by the influence of heat.—Taylor, *Med Jur*, p. 715.

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In order to start the combustion of an inflammable substance, a portion of it—no matter how small—must be raised to a particular temperature. The temperature required varies with the substance. A mass of phosphorus will take fire if any portion of it be raised to the comparatively low temperature of 140° F. Hydrogen, on the other hand, requires a high temperature for its ignition. When a portion of the inflammable substance, or mixture of inflammable substances, is capable

of heat by chemical action, such chemical action taking place either between the substance and the oxygen of the air, or, in a few cases, between two of the constituents of a mixture. The principal substances liable to spontaneous combustion are:—

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varieties of coal contain iron pyrites (sulphide of iron) in considerable quantity, and are liable to spontaneous combustion from heat developed by the combination of this with the oxygen of the air. Again, the constituent undergoing oxidation may be an organic substance, *e.g.* a drying oil. Numerous cases are on record of the spontaneous ignition of fibrous

drying oils. Woody fibre moistened with turpentine has been known to catch fire from a similar action.

Organic matters moistened with water only, *e.g.* damp hay, cotton, tow, flax, cocoanut fibre, leaves, etc., are liable to become heated from oxidation. Spontaneous ignition of damp hay and cotton, and of damp oats and esparto grass, has been known to occur. It may also be

remarked that certain explosive substances are liable to explode either spontaneously, *e.g.* chloride of nitrogen, or from a very slight amount of percussion or friction, *e.g.* nitro glycerine, the metallic fulminates, and mixtures of combustible substances with potassic chlorate.

Case—So-called 'spontaneous' combustion of the human body.—In the *Phil. Trans*, Vol. XLIII. p. 463, it is recorded that "Grace Pett, the wife of a fishmonger at St Clements, Ipswich, used to go downstairs every night, half dressed, to smoke a pipe. On the 9th of April, 1744,

of coals covered with white ashes. The head, the arms, the legs, and the thighs had also participated in the burning. This woman, it is said, *had drunk a large quantity of spirituous liquor*, in consequence of being overjoyed to hear that one of her daughters had returned from Gibraltar. There was no fire in the grate, and the candle had burnt entirely out in the socket of the candlestick, which was close to her. There were also found near the consumed body the clothes of a child and a paper screen, which had sustained no injury. Her dress consisted of a cotton gown."—Woodman and Tidy, *For Med.*, p. 1010

Case.—Spontaneous combustion put forward as a defence to a charge of murder. "In March, 1830, a man named *Stauff* was tried at Darmstadt for the murder of the *Countess of Garditz*. He had assaulted the deceased in her chamber, and then set fire to the furniture, with a view to conceal his crime. The body and dress were partially consumed. As the means by which the fire was applied were not at once apparent, and the assassin had locked the doors of the room, some medical men took

Death from HEAT.

SUNSTROKE, INSOLATION, 'COUP DE SOLEIL,' HEAT-APOPLEXY.

Death from heat seldom becomes the subject of medico-legal inquiry except in cases of sudden death in heated engine-rooms or factories or cases found dead in railway carriages, where there is suspicion of foul play.

Death from heat may occur in two ways—

(1) **Heat Exhaustion**, sudden syncope or faintness from exposure to high and usually moist temperature of the air. Patient suddenly feels faint, turns pale, pulse is weak, soft and fluttering, respiration shallow, skin cold, temperature sub-normal.

(2) **Heat-Stroke or Sun-Stroke**, usually by exposure to intense sun-heat. The symptoms may set in suddenly, or there may be premonitory symptoms, such as headache and vomiting. These are followed usually by confusion of vision, flushing of the face, conjunctivæ congested, and stupor or coma. The temperature is invariably high. The pupils are generally dilated in the earlier, and contracted to a fine point in the later, stages. In a few cases delirium and convulsions are present. Death has been known to occur in five minutes, or as late as three days, after the commencement of the attack.

Circumstances modifying the effect on the system of exposure to heat are,—

1 **Moisture present in the atmosphere**—Other things being equal, the less this is, the better exposure to heat is borne. The presence of a large amount of moisture in the atmosphere interferes with evaporation from the surface of the body, and favours the action of heat on the system.

2. **Duration of exposure.**—Very high temperatures can be borne for a short time, but not for long, without ill effects. Chabert, 'the Fire King,' was in the habit of entering an oven the temperature of which was from 400° to 600° F.

3. **Habit.**—This appears, to a certain extent, to lessen the effect of exposure to heat. Individuals accustomed to carry on their daily work in an atmosphere of high temperature, apparently withstand the action of heat better than others.

4. **Bodily condition of individual**—The action of heat on the system is favoured by exhaustion, indulgence in alcoholic liquors, or anything which checks elimination, or embarrasses the normal working of the organic system. In 90 per cent. of cases of Heat-Stroke personally examined in Eastern Bengal and Bombay, Powell has found evidence of (1) malaria, (2) alcoholic excess, or (3) syphilis, sometimes all three in the same case.

Post mortem appearances.—In some cases no abnormal appearance has been present. In the majority of cases, congestion of the brain and its membranes, engorgement of the right side of the heart and congestion of the lungs and abdominal viscera are found. The blood is frequently fluid and dark in colour, hence there is great *post-mortem* lividity and decomposition sets in rapidly.

Death from COLD.

If, from exposure to cold, the temperature of the human body becomes reduced for any length of time much below the normal, death occurs. In exceptional cases the temperature of the body has been known to fall as low as 79° , or even 75° F., without life being extinguished.

Constitutional symptoms produced by exposure to cold are depression of the heart's action, and torpor, succeeded by stupor or coma, from congestion of the nervous centres. In addition, exposure to cold may produce certain local effects, e.g. chilblains or, in severe cases, frost-bite, the part affected becoming, when frost-bitten, bloodless, ash-grey, and insensible. If a part affected with frost-bite is warmed too suddenly, gangrene is apt to set in, hence, warmth should be restored to frost-bitten parts gradually, as, for example, by friction with snow.

Circumstances modifying the action on the system of exposure to cold are —

1. **Wind.**—Air being a bad conductor of heat, cold still air produces much less harmful effect on the body than cold air in motion, as in a wind.

2. **Moisture.**—If the surface of the body be wet, or covered with wet clothing, and exposed to cold air, heat, owing to evaporation, is withdrawn more rapidly than if the surface of the body be dry.

3. **Duration of exposure.**—Of course the longer the exposure to cold, the more likely are ill effects to occur. Adopting proper precautions, however, an extremely low atmospheric temperature may, as in the case of arctic voyagers, be borne for long periods.

4. **Age.**—Adults bear cold better than the very young and very old.

5. **Bodily condition.**—The action of cold on the system is favoured by anything which tends to lower the vital powers, e.g. fatigue, exhaustion, intoxication, want of food, etc.

Post mortem appearances are not very characteristic, they are, according to Ogston.—(a) Arterial hue of blood generally, except when viewed in mass within the heart. (b) Unusual accumulation of blood on

brain in three, and of the liver in seven, out of sixteen cases.

11.2.

to cold, sometimes form the subject of a medico legal inquiry. Taylor

mentions a case where the death of a lunatic appears to have occurred from the combined effect of a shower-bath at 45° F. for half an hour, followed by a full dose of tartar emetic.

Death from LIGHTNING and ELECTRICITY.

Death by lightning with marks of violence on the body which have been attributed to murder sometimes require medico-legal investigation.

The human body is a feeble conductor of electricity, it allows of the passage through it, by conduction, of charges of electricity up to a certain pitch of intensity; but if this be exceeded, discharge taking place through the body becomes of the nature of a disruptive discharge. The passage of a feeble charge of electricity by conduction through the body usually produces no ill-effects. A strong charge—strong enough to kill

showing marks of burning; metal articles attached to the clothes, such as buttons, or carried in the pockets, show signs of fusion, and steel articles, a knife for example, are found to have acquired magnetism.

Conditions of lightning stroke.—Lightning stroke has occurred in almost every situation. Thus persons have been struck by lightning in the open, in houses (in one case a boy in bed was struck by lightning),

their insufficient thickness, opposing so much resistance as to cause

ing from the discharge of atmospheric electricity are the cases in which individuals are killed by what is called the 'return shock.' In these cases the person killed is sometimes at a considerable distance from the spot where the discharge of lightning takes place. Cases of this kind are explained as follows. A cloud charged with electricity induces a charge of the opposite kind in objects—e.g. the bodies of individuals—in its neighbourhood. When the cloud discharges itself, the inducing influence being suddenly withdrawn, these objects suddenly discharge

their induced charge of electricity. Sometimes this discharge of induced electricity from the body of an individual is so violent as to produce a severe or even fatal shock. In cases of this kind no marks of injury are found on the body of the sufferer.

Death or injury from electricity other than atmospheric electricity.—This is usually by accident. Powerful 'arc' electric lamps (i.e. lamps in which the light is produced by disruptive discharge between carbon terminals), require currents of great intensity. Two or three cases have lately been recorded where individuals have been killed by accidentally

of hanging.

The effects produced on the body by the passage through it of an electrical discharge may be—(1) Local; (2) Constitutional.

Local effects produced may be burns, blisters, or wounds; or ecchymosed streaks, spots, or patches. Burns and blisters are sometimes the result of the clothes having caught fire, but may occur independently of any ignition of the clothes. The hair is often found singed. If a wound is found it may be lacerated, punctured, or contused in character. Ecchymosed or livid patches, spots or streaks are frequently met with. Sometimes the streaks present a peculiar arborescent appearance. Fractures are rare, but have been found in a few cases (Tidy). No marks whatever may be found on the body, even in fatal cases, in which the clothes have been burned.

(2) **Constitutional effects** produced may be immediate death from shock; or the individual may fall down insensible and die after an interval, varying from a few minutes to several days. In one case death occurred as late as the thirty-third day after the receipt of the injury. If immediate death is not caused, the probabilities appear to be in favour of recovery taking place. In non-fatal cases various nervous affections have been found, e.g. paralysis (hemiplegia or paraplegia), loss of sight, hearing, speech, or memory; or there may be no apparent effect beyond the momentary shock if the current is slight.

Signs of death or injury from electricity may be—

1. **External marks on body.**—The nature of these has been already described. The livid arborescent streaks found on the body in some cases are peculiarly characteristic of death from lightning stroke. The marks present on the body may simulate in appearance marks of mechanical violence.

3. **Objects on or near the body** may show signs of the passage of electric discharge. The clothes may be found burnt or torn, the boots have sometimes been found burst open. In one case the whole of a man's

clothes were torn off his body and scattered about. Metal articles attached to the clothes or carried in the pockets may be found fused ; and steel articles may be found to have become magnetic. Objects in the neighbourhood of the body may be found to show signs of injury, *e.g.* a wall or building may be found cracked, or shattered and thrown down. Trees may be found split, and combustible objects, especially if dry, may be set on fire, or show marks of burning.

Rigor mortis sets in rapidly and putrefaction may be hastened.

CHAPTER IX.

DEATH FROM STARVATION.

ACUTE and chronic starvation have similar symptoms. In acute starvation death takes place usually in ten to twelve days, accompanied by mania and convulsions.

The essential nutritive constituents of food are (1) Albuminates, (2) Carbohydrates, (3) Fats, and (4) Salts. In order to maintain health and strength, a certain amount of each of these, plus a certain amount of water, must be daily supplied. Of the essential nutritive constituents of food the albuminates, *e.g.* albumen and casein, contain both carbon and nitrogen.

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nutritive nitrogen, and the carbon contained in albuminates carbohydrates, and fats nutritive carbon.

The daily food requirements depend (a) on the weight (in health) of the individual to be fed, (b) on the amount of work performed, and (c) on the age of the individual (children require more food in proportion to their weight than adults, seeing that in their case growth as well as nutrition must be provided for). An adult requires daily if at rest 25 grains, or if at work about 30 to 45 or 50 grains (according to the amount of work done) of nutritive carbon per 1 lb. of body weight. With this amount of carbon, nutritive nitrogen must be supplied in amount equal to one-fifteenth to one-twentieth of the weight of the carbon. The food must contain fat in a certain amount, say about 1 to 3 ounces per diem. The food must contain salts in a certain amount, *e.g.* phosphates, required for the nutrition of the body, also a certain amount of common salt, say $\frac{1}{4}$ to $\frac{1}{2}$ an ounce; water, 3 to 6 pints daily, and condiments. The food should be varied in character, of good quality, properly cooked, and the intervals between meals should not be too long.

A rough rule for calculating the daily food requirements of adult natives of India is as follows:—Given (a) that the food consists solely of cereals and pulses fairly free from husk, and that the dietary contains a sufficiency of fat, and (b) that the amount of nutritive nitrogen in the dietary equals about one-twentieth of the carbon, then the number of ounces of food daily supplied must be not less than the average body weight in pounds of the individuals to be fed, multiplied by:—1 for bare subsistence, 0.16. For light work, say not over 1 foot-ton per 1 lb. of body weight, 0.21. For moderate work, say not over 2 foot-tons per 1 lb. of body weight, 0.26. For hard work, say up to 3 foot tons per 1 lb. of body weight, 0.31.

Rapidity with which ill-effects follow deficient supply of nourishment is affected by—

1. **Age.**—Old persons bear deprivation of food better than adults, and adults bear it better than children.

2. **Condition of body.**—Fat people bear deprivation of food best. Diminished activity of the vital functions (as in catalepsy) delays the occurrence of ill effects from deprivation of food.

3. **Exposure to cold.**—Where the loss of heat from the surface of the body is rapid, the effects resulting from a deficient supply of the matters (food) required to maintain the normal temperature are more quickly felt than when the loss of heat from the surface is slow.

4. **Deprivation of water.**—Complete abstinence from both food and water kills more rapidly than abstinence from food alone. Taylor¹ states that it is probable, that in a healthy person under perfect abstinence (from both water and food), death would not commonly take place in a shorter period than a week or ten days. Guy² mentions a case of shipwreck where, of eighteen persons deprived of food and water, only one survived the eighteenth day. Where the abstinence is from food only, an individual may survive for a much longer period. Thus a case is recorded of a madman who survived forty-seven days, and another of survival for sixty-one days, in the first of these two cases water only was taken, in the second water and a little orange-juice.

Symptoms of starvation—The chief —

1. **Emaciation, loss of weight.**—The subcutaneous fat disappears and the muscles waste; so that the skin of the face becomes wrinkled, and that of the body, especially in previously plump persons, becomes baggy. Chossat, from a series of experiments on animals, found, as a rule, death to occur when the animal had lost two-fifths of its weight. Observation seems to indicate that this rule holds fairly good in the case of human beings.

2. **Exhaustion and weakening of voice.**

3. **Pallor and cadaverous look.**

4. **Thirst, pain and irritation of the stomach, and usually a costive condition of the bowels.** The outlets of the body are frequently found inflamed.

5. **Pulse is at first quickened, but subsequently becomes slow.** It usually, however, becomes greatly quickened on the approach of danger.—Tidy.

6. **In chronic cases especially, the skin frequently becomes covered with "a brown filthy looking coating," and the body emits a fatid odour.** "The gums become swollen and ulcerated, and there is great tendency to ulceration and sloughing on the receipt of slight injuries."—Cornish.

7. **Wild-looking eyes, delirium and convulsions in some cases precede death, in other cases the mind remains unaffected.**

Post mortem appearances. These are chiefly great emaciation, a shrunken and contracted condition of the stomach and intestines with pale pearly and translucent coats, a more or less atrophied condition of the viscera, and absence—not necessarily complete in acute cases (see

¹ *Med. Jur.*, II 139

² *F. & M. J.*, p 312.

Case below)—of fat. It should be noted, however, that all these appearances may be present in death from exhausting diseases. Hence in cases

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in which this question arose, see below).

Case —Prolonged sleep with starvation.—A man of healthy habits, 43 years of age, was at intervals subject to attacks of long and persistent sleep. He would retire to bed at his usual hour, and without any warning symptoms, suddenly and almost immediately fall into a profound sleep,

slept three days, and occasionally four days, without waking, but his average period was two days. His secretions were suppressed, and no food was required. He commonly awoke suddenly, had no consciousness of the lapse of time, and retained a good remembrance of the last occurrences before he fell into this state. He had no dreams.—Taylor, *Med Jur*, I 43

Case —Homicidal starvation.—Death from disease set up as a defence. —Deceased, Harriet Staunton, had been kept in close confinement by the accused. She was seen, a few hours before her death, by a medical man, and was then insensible and collapsed. She died in a state of complete exhaustion. On *post mortem* examination appearances indicative of death from starvation were found, the body-weight being only 74 lbs. instead of about 120 lbs., as it would have been in a healthy adult of the same age. The following *post mortem* appearances of disease were present:—(1) A slight tubercular deposit at the apex of the left lung. (2) A congested appearance of the cardiac extremity of the stomach, as well as of the duodenum. (3) Two small patches of milary tubercular

death was due to starvation. Three of the four accused were convicted. —*Reg. v. Staunton*, Taylor's *Manual*, p. 469.

Starvation may be accidental, homicidal, or suicidal.—The most common causes of accidental starvation are:—(1) Shipwreck; (2) Mining accidents—individuals by a fall of earth getting shut up in a mine; (3) Disease, *e.g.* stricture of the œsophagus; and (4) Famine.

In Homicidal cases the victim is usually an infant or child. The withholding of food, with or without exposure to cold, is a not infrequent method of infanticide (see 'Infanticide'). Cases also are not infrequent where children have been starved by their parents or other persons having charge of them,—'baby-farmers.' In fatal cases of this kind, as already

pointed out, the body should be carefully examined for signs of disease, especially chronic wasting disease. In non-fatal cases, an unusually low body-weight, coupled with a rapid gain in weight when proper nourishment is administered, is very strong evidence in favour of starvation (see *Case* below). As already pointed out under Suffocation, in no form of *samadh*, or burial alive of lepers, the head is left uncovered, and death takes place from exhaustion, the result of starvation and exposure; and not—as in cases where the burial is complete—from suffocation. Suicidal cases are rare, but are sometimes met with, especially in the insane and prisoners who sometimes attempt to commit suicide by starving themselves.

Case.—Starvation; rapid gain of weight under proper feeding.—Prisoner charged with starving his servant, *æt.* 13½ years. The girl weighed thirty-five pounds. She suffered, in the cold weather, from chilblains and sloughing of the toes. When removed and properly fed she recovered her health, and gained weight at the rate of five ounces per diem for 129 days.—Tidy, *Leg Med*, I p. 603, *Lancet*, August 14, 1880

Pretended fasting.—Cases are on record where individuals,

watching the impostor with a view to detection, as if death results he may be held criminally responsible. In the case of the Welsh fasting-girl, the medical men who had accepted the responsibility of superintending the watching were indicted before the magistrates along with the parents of the girl; the parents only, however, were committed for trial.

SEXUAL CRIMES AND OFFENCES.

CHAPTER X.

IMPOTENCE AND STERILITY.

SEXUAL capacity is a question that may arise with reference to marriage, charges of rape, etc.

Marriage, according to the law of England, is a contract which may be declared null and void by the court on proof that either of the parties thereto is incapable of fulfilling its terms, *i.e.* of consummating the marriage. Hence a suit for the declaration of nullity of marriage may be brought by one of the parties to the contract on the ground that the other is impotent or incapable of sexual intercourse. To obtain a decree declaring the marriage null and void on this ground it must, however, be proved: (*a*) that the incapacity existed at the time of the marriage; and (*b*) that it is of such a nature as to be incurable, or only curable by an operation to which the individual refuses to submit (see *Case*, p. 254). A marriage may also be declared null and void on the ground of insanity of one of the parties thereto at the time of the marriage (see 'Insanity').

'**Impotence**' is the incapacity for performing the sexual act and '**sterility**' may exist in either sex, but the existence of one of these conditions does not necessarily imply the existence of the other, *e.g.* an individual may be sterile, but not impotent; or impotent, but not sterile. Sterility by itself offers no legal ground for a divorce while impotence may do so. In practice the two disabilities resolve into impotence in the male and sterility in the female. The question of the impotence of an individual may arise in (1) nullity of marriage suits; (2) rape cases, where impotence may be pleaded as a defence by the accused (see 'Rape,' Chap. XIV.), and similarly, in other cases, impotence may be set up as an answer to a charge of adultery;

(3) cases of disputed right to inherit (see this subject), where an individual is alleged to be an illegitimate, or a supposititious child—here both Sterility and Impotence come in; also in (4) cases where, under certain circumstances, a woman seeks to have absolute control given to her over money, on the ground that she has no children, and is past the age of child-bearing.

Recorded instances of capability of reproduction in very advanced life are: Cato the censor, who is said to have had a son at eighty years of age, Zadisias, king of Poland, at the age of ninety married his second wife and had two sons. As a fact spermatozoa can often be detected in the testicles of very old men; Duplay discovered them in nine octogenarians.

In the male.

A male may be impotent or sterile or both, owing to (1) extreme youth, (2) advanced age; (3) malformation or defect; (4) disease, (5) mental causes, (6) drugs.

(1) **Extreme youth.**—According to the law of England, the earliest age at which a male can contract a valid marriage is fourteen; and a male under the age of fourteen is held incapable of committing a rape.* It appears, therefore, to be a presumption of English law that a boy does not attain puberty and become potent for coitus until he has reached the age of fourteen. The law of India contains no similar presumption; a boy under the age of seven is (*J. P. Code*, s. 82) held to be incapable of committing rape or any other offence. Over that age, the question of his capacity to commit rape is a question left to the courts to decide according to the evidence produced in the case. The age at which males attain puberty, and become soon capable of performing sexual intercourse, varies. The general age among Europeans is probably about fourteen, and among natives of India somewhat earlier. In exceptional cases puberty is attained at a very early age. Tidy mentions a case of a boy who was given to masturbation from the age of three, and of another boy aged four and a half, who attempted intercourse with his sister aged two.¹ In other cases puberty is not attained until a comparatively late age. Taylor mentions a case of a man whose penis and testicles at the age of twenty-six "but little exceeded in size those of a youth of eight years of age." This individual married, became the father of a

* Tidy, *Ley Med.*, II p 77

family, and at the age of twenty-eight the organs became fully developed.¹

Attainment of puberty and potency does not, however, necessarily imply coincident attainment of fertility. Until spermatozoa appear in the seminal fluid, an individual is sterile. Casper considers that the power of procreation commences later (and ceases earlier) than the capacity for coitus. Taylor gives fourteen as the earliest age at which the procreative power has been recorded to appear in the male.² Aspermatism can be detected by the microscope.

(2) **Advanced age** may of course be a cause of impotence or sterility in the male. Cases, however, are recorded of the procreation of children by men of seventy-one, eighty-one, and ninety-two; and spermatozoa have in several cases been found in the seminal fluid (indicating fertility) of men over ninety.³ Casper once found them in a man aged ninety-six.⁴ In English law there is no age from fourteen upwards at which a man is denied the power of procreating children.

(3) **Malformation or defect.**—Impregnation may result from the mere deposition of semen within the vulva.⁵ No malformation or defect of the penis, therefore, can be regarded as an undoubted cause of impotence, unless it is of such a nature as to completely prevent such deposition. This being so, impotence results from complete loss or absence of the penis, or from its orifice being situated, as in complete hypospadias or epispadias, in such a position that deposition of semen within the vulva during coitus is impossible. Impotence has thus resulted from perineal fistula. For the reason above mentioned, impotence is not necessarily the result of partial absence or loss of the penis, or of partial hypospadias or epispadias. Adhesion of the penis to the scrotum or abdomen may cause impotence remediable by a slight operation. Individuals impotent from malformation or defect of the penis are not necessarily sterile, it being possible to effect impregnation by artificial injection of the seminal fluid.

Loss of both testicles, or absence of both testicles, of course involves impotence and sterility. The power of procreation may, however, remain for a limited period after the removal of both testicles, owing to presence of accumulated seminal fluid in the vesiculae seminales. Loss of one testicle

¹ Taylor, *Med. Jur.*, II. p. 250.

² *Ibid.*, p. 291.

³ *Ibid.*, p. 285.

⁴ Casper, II. pp. 258, 291.

⁵ Tidy, *Lec. Med.*, II. p. 14.

only does not result in impotence, nor are those who have one testicle only (*monorchids*) impotent (see *Case*, p. 255). Individuals in whom the testicles have not descended (*cryptorchids*) are not necessarily impotent; many, but not all, are, however, sterile (see *Cases* below, and over page)

Case.—A nullity of appeared that the woman cured by an operation she refused to submit. could not compel her to take all reasonable means to persuade her. This he has done, and she has distinctly refused (*L. R. 7 P. Div. 16*).—*Tidy's Leg. Med.*, II. p. 102.

Case.—Procreation by cryptorchid.—A man in whom the testicles had not descended at the age of 30, had been twice married, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service.—*Taylor, Med. Jur.*, II. p. 288.

Case.—A similar case.—Case of a man in whom the testicles had not descended, reported by Mr Poland. This man married when he was 20, had two children by his first wife, and at the time of his admission into hospital (for hernia) had been married two years to a second wife.—*Ibid.*

Case.—Procreation by a monorchid.—"Willunct, the first wife of one John Bury, alleged that he was impotent; and on inspection by two physicians, he was found to have but one testicle, the size of a small bean, while she was a virgin. On this and other circumstantial evidence, the Ecclesiastical Court annulled the marriage. But Bury took a second wife, by whom he had a son."—*Case of John Bury*, temp. Queen Elizabeth, *Guy, For. Med.*, p. 48

(4) *Disease*.—Local disease may cause temporary and remediable impotence, *e.g.* elephantiasis and large hydrocele, from mechanical obstacle to coition, and stricture of the urethra, from mechanical obstruction to the flow of semen. Local disease may also cause permanent and incurable sterility, *e.g.* advanced disease of the testicles, or wasting of the testicles after inflammation, this last has been observed as a result of metastatic parotitis. Lithotomy has been known to cause sterility, probably from injury to the ejaculatory ducts.

Constitutional diseases, if of an exhausting nature, may produce temporary impotence, but general diseases, not affecting the brain or spinal cord, or not producing great debility, do not usually cause impotence.¹ Injury or disease of the brain or spinal cord may cause impotence or sterility. Curling relates several cases of impotence caused by blows on the

¹ *Taylor, Med. Jur.*, II. p. 222

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¹ Taylor, *Med. Jur.*, II. p. 220.

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⁵ Tidy, *Lect. Med.*, II. p. 14.

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Case.—A nullity of marriage case.—In the case of *L. v L.*, it appeared that the woman was impotent, but that she might possibly be cured by an operation involving no great risk of life, to which, however, she refused to submit. The court, in granting the decree, said that it could not compel her to submit, and the man can only be expected to take all reasonable means to persuade her. This he has done, and she has distinctly refused (*L. R. 7 P. Div. 16*).—*Tidy's Leg. Med.*, II p. 102.

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¹ Taylor, *Med Jur.*, II p. 292

head, especially on the back and under-part of it; in some cases of this class recovery takes place, but in others wasting of the testicles and permanent sterility follows.¹ Paraplegia from injury to or disease of the cord, according to Curling (and probably also locomotor ataxy) has no direct effect on the testicles, but may cause impotence by destroying the power to copulate. Wasting of the testicles and sterility may, however, follow. In one case quoted by Curling, a man suffering from paraplegia of some years' duration retained sufficient sexual power to have prolific intercourse. Hemiplegia may cause impotence, but Guy mentions two cases where men, within three weeks of an attack of hemiplegia, had sexual intercourse with their wives and begat children² (see *Case* below). Over-indulgence in certain intoxicating or narcotic drugs, *e.g.* alcohol, opium, cannabis, and tobacco, is said to cause sterility. Sterility has by some men been stated to occur in chronic lead-poisoning.

Case.—*Bagot v Bagot* (Irish Probate Court, 1878), Dr. Radcliffe stated that he himself has seen cases of ataxy in which sexual capacity and fruitfulness were retained—Guy, *For Med.*, p. 49.

Case.—Procreation after an attack of hemiplegia—"E. K., *æt.* 58, when 33 years of age, had a well-marked attack of hemiplegia of the right side, which has left him lame, and with his speech slightly affected. He alleges that he had connection with his wife within a week of his seizure, that his sexual powers have not been impaired, and that since his attack he has had three children always considered as his own. His wife gives three weeks as the extreme limit of time after the attack, at which connection took place."—Guy, *For. Med.*, p. 50

(5) **Mental causes.**—Excess of passion, timidity, fear, etc., may cause temporary impotence. Individuals may, it is alleged, be impotent or sterile as regards a particular female, but not as regards others (see *Cases* below).

I. p. 315.

(6) **Drugs.**—Diuretics, carbonate of soda, etc., have a marked anaphrodisiac action. Quinine, by causing emissions, has a reputation for tending to impotence.

¹ Taylor, *Med. Jur.*, II. p. 291.

² *For. Med.*, p. 49.

Sterility in the Female.

A female may be sterile owing to (1) extreme youth; (2) advanced age; (3) malformation or defect, (4) disease.

(1) **Extreme youth.**—According to the law of England twelve is the earliest age at which a female can contract a valid marriage; it would therefore appear that the law of England presumes that a girl attains puberty and becomes potent at the age of twelve, though she cannot give her consent to the sexual act till she is sixteen years of age. Age of Consent in India.—According to the law of India (*P. Code*, s. 375), any female over the age of twelve can give a valid consent to sexual intercourse, and "sexual intercourse by a man with his own wife, the wife not being under twelve years of age, is not rape" Hence it would appear that the law of India presumes that a female attains puberty and becomes potent at the age of twelve

Commencement of Fertility is, as a rule, indicated by the commencement of menstruation. In a few cases, however, pregnancy has occurred before the appearance of menstruation, but no case of pregnancy at an earlier age than eight to nine has been recorded. Menstruation is not a sign of bodily maturity, it is in most cases merely a sign of puberty and ovulation with possible pregnability or capacity to conceive

The age at which the menstrual function becomes established varies greatly with the individual and climate. Among natives of Europe the general age at which it first appears is fourteen to fifteen. Out of 2000 cases, menstruation appeared in 211 between the ages of ten and twelve, in 1462 between thirteen and sixteen, and in 318 between seventeen and twenty. In one case only did it appear as early as nine, and in one only, as late as twenty-two. Among natives of warm climate menstruation occurs earlier than among natives of temperate climates. Among natives of India menstruation so early as ten is uncommon, but its appearance is seldom delayed beyond the fifteenth year. The menstrual flow commonly lasts from two to four and a half days. The menstrual period, from the commencement of flow to commencement of flow in exceptional cases is twenty-eight days.

The influence of Tropical Climate on menstruation seems to have been overestimated. The following table are given the comparative results of observations at Calcutta in 3182 cases amongst natives.

and Indian-born girls as to the age at which menstruation first appeared. In the class of pure native Hindus and Mohammedans, but chiefly the former, the greatest percentage of dates for first menstruation occurs between the 12th and 14th years, amounting to 65·7 of the whole class. Eurasians approach the native type between the ages of 12 to 14 years, but diverge again towards the European type between 14 to 16 years of age.

AGES OF FIRST MENSTRUATION IN INDIA IN YEARS.

Race		10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Europeans	174	3·7	6·1	13·4	23·4	21·2	16·7	8·3	6·1	1·6
European, country-born	387	0·7	3·6	10·8	25·8	21·8	17·3	12·4	3·1	1·2
Eurasians	795	0·7	0·2	22·0	31·8	22·0	10·5	4·2	1·7	0·6
Natives	1752	2·0	10·4	36·4	20·3	13·9	4·5	2·2	0·2	0·04
Jewesses	73	—	2·7	9·5	34·2	34·2	17·8	1·8	1·3	—
Chinese	8	—	—	12·5	62·5	12·5	—	12·5	—	—
Total	3159	—	—	—	—	—	—	—	—	—

The cause of the earlier menstruation in hot climates seems partly due to the shorter duration of life, with its consequent earlier maturity, and partly to the social differences, whereby in the tropics, children early gain precocious knowledge of sexual matters, owing to the want of privacy in oriental domestic life. Thus an experienced observer states that it is doubtful "if there are any little boys and girls in native houses in this country who have reached the age of ten years who do not have a very fair knowledge of what the sexual relations and child-bearing really mean." In addition, there is the precocious sexual excitement of too early marriages at the age of ten to twelve years, with its many possibilities of sexual intercourse, authorized by native customs, though now made illegal by British law.

(2) **Advanced age and Cessation of Menstruation.**—Menstruation usually ceases between the ages of forty and fifty, but has been known to cease as early as twenty-three. On the other hand, there are on record several cases of menstruation at over sixty years of age, and one as late as seventy-seven. As a rule fertility ceases with the cessation of menstruation,

but Taylor¹ mentions a case of a lady aged forty-four who was delivered of her tenth child eighteen months after the entire cessation of the menses. No general rule can be laid down as to the age at which, in the female, fertility ceases.

The question whether a woman is past child-bearing is of practical importance in cases where money has been settled on or bequeathed to a woman absolutely, in case she has no children, but in case of having children, only for her life with remainder to her children. In these and similar cases, where the woman has attained an advanced age without having had children, it is presumed she is incapable of having issue, and she is held absolutely entitled to the money, in which, if she had children, she would only have a life interest. No particular age is fixed as the period when such presumption arises.

of *In re Widow's Trusts* (L. R. 11 Eq. p. 409) the presumption was acted on in the case of a widow aged fifty-five years and four months, and a spinster aged fifty-three years and nine months. In *Norton v. May* (9 Ch. Div., p. 368) the court refused to presume no possibility of issue

(3) **Malformation or defect.**—Complete absence or occlusion of the vagina of course causes impotence. Occlusion may be remediable by operation. For occlusion to act as a cause of sterility it must be complete; "the slightest aperture will often suffice for impregnation."² Many cases are recorded where during labour the vagina has been found occluded to so great an extent as to require incision in order to effect delivery. Ogston mentions a case of "a woman who had a vagina so narrow as scarcely to admit a quill," but who, after being married eleven years, became pregnant, when the vagina "dilated of itself sufficiently to admit of delivery at the full term."³ Absence of the ovaries or uterus of course causes incurable sterility. In such cases, however, there may be no external defect or malformation, and the cause of the sterility may be consequently only be ascertainable after death.

¹ *Med. Jur.*, Vol. II, p. 17.

² Taylor, *Med. Jur.*, l. p. 302.

³ *Lect. Med. Jur.*, p. 85.

(4) **Disease.**—Impotence or sterility in the female may arise from a variety of diseased conditions. There may, for example, be excessive irritability of the vagina, preventing coitus and causing impotence (see *Cases* below). Again, effective coitus may be prevented by ruptured perinæum, or recto-vaginal fistula. Sterility may result from disease of the ovaries, obstruction of the Fallopian tubes, or of the neck of the uterus, displacements of the uterus, etc., etc. Acid discharges from the vagina or uterus may cause sterility by acting destructively on the spermatozoa, or preventing their access to the ovum. Paraplegia in the female, it may be noted, does not always prevent either impregnation or delivery."¹

Case—Hysteria a cause of impotence in the female.—"In this case, where the parties had cohabited for two years and ten months, and the man's capacity and desire to consummate were not questioned, the court being satisfied of the *bona fides* of the suit, and of the practical impossibility of consummation in consequence of the hysteria of the woman, pronounced a decree of nullity, although there was no structural defect in the woman."—Tidy, *Leg. Med.*, II p. 102, *G. v. G.*, L. R. 2 P. & D. p. 287.

Case.—A similar case.—"In a suit for nullity of marriage, it appeared from the husband's evidence that whenever he attempted to have intercourse with his wife the act had produced hysteria on her part; and that, although he had cohabited with her for more than three years, the marriage had never been consummated. The wife refused to submit to inspection. Decree nisi granted."—Tidy, *Leg. Med.*, II. p. 103. *Case of H. v. P.*, L. R. 3 P. & D. p. 126.

¹ Woodman and Tidy, *For. Med.*, p. 684.

CHAPTER XL

VIRGINITY AND DEFLORATION.

ONE of the questions which may arise in nullity of marriage suits is as to whether a certain female is '*virgo intacta*' or not. The same question may also arise in other cases, *e.g.* (1) in divorce cases and defamation cases; (2) in cases where

rape (see 'Rape'), and this may be effected without destruction of the signs of virginity. (See Figs. 22 to 25, pp. 263-4.)

Case.—Two women afterwards found to be prostitutes; result of

some time on the registers of the police, and had both had repeated attacks of the venereal disease.—Guy, *For. Med.*, p. 56, quoted from Parent-Duchatelet.

1. **The Hymen.**—The most reliable sign of virginity is an intact hymen.

(1) *Is the hymen always present?*—At one time it was alleged by many authorities that the hymen was frequently absent. This view has, however, been proved by later observations to be erroneous. It was found, for example, to be present in each one of the 650 cases examined by Devilliers, Orfila,

and Tardieu.¹ Capuron, however, records a case of congenital malformation of the genitals with absence of the hymen.²

(2) *What is the natural condition of the hymen in the virgin?*—Practitioners often have the most vague conception of the hymen and mistake for it the thin margin of the fourchette. Powell's practical directions for its examination are given in Appendix VIII. A very common form of the membrane, after the age of

diaphragm,
large and

the vaginal orifice. In a third set of cases the hymen has been described in late observations as a sort of diaphragm, exactly and regularly circular, pierced by a central opening. A fourth form assumed by it, and that its most common appearance, is that of a semicircular fold of integument stretched across the lower border of the vaginal orifice, its free border concave and notched (*échancré*), and its extremities losing themselves in the labia minora. Lastly, the hymen has been occasionally encountered in the shape of a mere narrow fringe around the entrance to the canal of the vagina, in one case as a sort of bridle across the vagina, with a passage on each side; in another as a complete septum, pierced by numerous minute openings; and in a third instance as a double septum, without any opening whatever into the vagina. The entrance to the vagina is thus practically closed or narrowed by the hymen, which in early life is most usually vertical, but by the natural development of the parts gradually assumes a horizontal direction. Towards puberty more firm and consistent than in early life, as menstruation becomes established it becomes more or less flaccid, presenting less resistance to their flow, and is more easily lacerated.

(3) *What changes are produced in the hymen by sexual intercourse?*—As a general rule, when sexual intercourse takes place, the hymen is lacerated or ruptured, in the latter case giving rise to "those small pyramidal tubercles, from three to six in number, known as the *carunculae myrtiliformes*."³ If, however, the aperture in the hymen be larger than usual, or the membrane itself be lax, repeated intercourse may take place without rupture or even laceration. Many cases are recorded, in fact, where the hymen has existed all through pregnancy, and has only ruptured at the time of delivery. In very young children the hymen, owing to its deeply seated position, and to the narrowness of the parts,⁴ is not usually even lacerated by intercourse.

¹ Oaston, *Lect. Med. Jur.*, p. 102.

² Guy, *For. Med.*, p. 53.

³ Tidy, *Lect. Med.*, II. p. 27.

⁴ *Lect. Med.*, II. p. 201.

Case—Hymen is present, and apparently intact, in prostitutes, etc.—At Martineau's service in the Broca (then Lourcine) Hospital in Paris I saw a girl who had come to the out-patient department for treatment of what was to all seeming an insignificant leucorrhœa. There was no obvious urethritis, nor were Skene's tubules affected, a point to which Martineau used to pay particular attention, and there was present a hymen whose orifice was barely two millimetres in diameter. But this girl was suffering from gonorrhœa, and admitted that she had infected several of her customers, she being a clandestine prostitute of the purloins of the Sorbonne. She had been on the town for over a year, and had entertained as many as five men in a single afternoon on a *fiée* day. Her hymen was elastic, and admitted of the passage of a large rectal bougie,

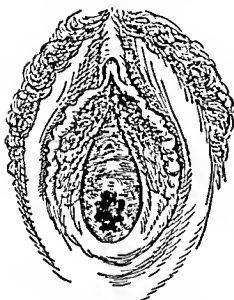


FIG. 22.—Intact Hymen, circular, with Natural Notches.

(From Peterson and Haines' *Legal Medicine*)

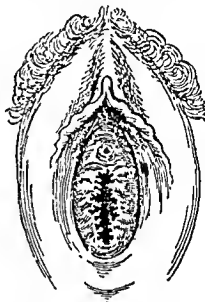


FIG. 23.—Intact Hymen, fimbriate.

(From Peterson and Haines)

returning to its obturator-like condition, when this was withdrawn.—W. D. Sutherland, *Ind. Med. Gaz.*, 1902, 245. See also *Case* below.

The hymen may be ruptured, on the other hand, by the introduction of foreign bodies other than the penis, *e.g.* (1) accidentally,—this, however, is extremely rare, or (2) by the introduction of instruments during an examination or surgical operation; or (3) in practising masturbation, especially if the body introduced is of large diameter; or (4) in endeavours to dilate the parts of young females, so as to render them *aptæ viris*: Casper mentions a case where the mother of a girl aged ten employed first her fingers and then a long stone for the purpose,

thereby lacerating the hymen;¹ and Chevers mentions the use in India for this purpose of the fruit of the plantain, and also of pieces of sola pith, the girl being made to sit in water, so that the pith may swell and dilate the parts.²

It has also been asserted that the hymen may be ruptured by indirect violence in a fall, or during violent exertion; this appears, however, to be very doubtful.

(4) Can virginity or non-virginity be inferred from the condition of the hymen? If the hymen is intact (not even

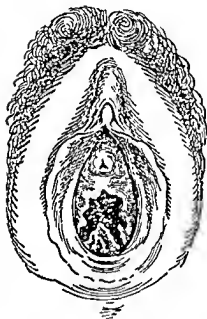


FIG. 24.—Ruptured Hymen, crescentic, with two Lateral Lacerations
(From Peterson and Haines' *Legal Medicine*)



FIG. 25.—Ruptured Hymen, circular, torn in Several Places,
(From Peterson and Haines.)

lacerated), the probabilities, except in the case of females below the age of puberty, are very strongly in favour of virginity; and the inference of virginity becomes almost certain if the membrane is normal in position and structure, and its aperture is of small size and undilatable; and if accompanying this condition of the hymen the other signs of virginity (see below) are present.

Case.—Evidence of virginity in disproof of alleged adultery.—It was alleged by defendant that the plaintiff, a married man, had had

¹ Taylor, *Med. Jur.*, II p 470

² *Med. Jur.*, p 689.

adulterous intercourse with a young woman, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. The late Dr Ashwell was called upon to examine the woman, and he deposed that, in his opinion, she was a virgin, and had never had a child—Taylor, *Med Jur*, II. p 441, *Frazier v Bayley*, Common Pleas, Feb. 1854.

Case—A similar case.—In this case, which involved an action for defamation of character, the plaintiff, a married man, *et. 64*, had been charged with committing adultery with a certain woman. Several witnesses for the defendant positively swore that they had seen these persons in carnal intercourse. This was denied by the plaintiff; and as an answer to the case, medical evidence was tendered to the effect that the woman, with whom the adulterous intercourse was alleged to have taken place, had been examined, and the hymen was found intact. In cross-examination, however, this was admitted not to be a conclusive criterion of virginity, and a verdict was returned for the defendant.—*Ibid.*, *Delafosse Fortescue*, Exeter Lent Assizes, 1853.

On the other hand, the absence of an intact hymen, although strong evidence of non-virginity, cannot be taken as conclusive proof thereof, seeing that, as already stated, the hymen may be ruptured or lacerated by the introduction of foreign bodies other than the penis.

{ } For a full and complete examination of the female genital organs, the following signs should be carefully observed.

..... narrow and rugose condition, the clitoris unenlarged, and the labia elastic and in close contact. (3) The *Fourchette* present (though it is not usually ruptured on first connection). (4) Absence of signs of previous delivery, of *fourchette* and perinæum entire. All such signs, taken by themselves, are unreliable as evidence of virginity, but are useful as corroborating evidence of virginity derived from the condition of the hymen.

Signs of Loss of Virginity.—These are the absence of the above signs of virginity and are:—(1) Torn hymen, (2) signs of injury, and (3) signs of implanted venereal disease—though all of these may be accounted for otherwise than by sexual intercourse.

CHAPTER XII.

PREGNANCY IN RELATION TO CRIME AND LEGITIMACY.

Age of Marriage for Hindus.

"If a man marry, he must select a maiden who is of a third of his age."—*Vishnu Purana*, 3, 10; Wilson's ed., 3, 101.

"Let a man of thirty years wed a lovely maid of twelve; or a man of twenty-four a maid of eight. If his virtue is being unpaired let him be expelled."

gest of Hindu Law," 3, 323.

THE law may request (*it cannot order*) a medical man to examine a woman to ascertain whether or not pregnancy exists, for the following reasons:—

(1) *To respite a woman condemned to be hanged or to hard labour.*—

(2) *The birth of a posthumous heir by a widow.*—Where a widow is suspected of feigning pregnancy in order to ultimately produce a supposititious heir to an estate of which her husband died possessed.—In such a case, according to the law of England, the heir-presumptive to the estate, i.e. the person who would succeed thereto, supposing the woman not to be pregnant, may apply to the court to order an inquiry to be made into the alleged pregnancy. The court, if it grants the application, does so by issuing what is technically called a writ "*de ventre inspiciendo*."

(3) *To increase damages in a seduction case*

(4) *To disprove libels in charges of adultery, etc.*—The woman alleged to be pregnant may be a married woman living apart from her husband, and the allegation may be put forward in support of a suit for divorce. Or she may be an unmarried female or a widow, who has been defamed and seeks to avoid disgrace.

(5) *In cases of alleged abortion.*—An attempt to cause miscarriage is an offence, irrespective of whether the woman be or be not pregnant. Further, according to the law of India (but not according to that of England), to cause, or attempt to cause, a woman "quick with child" to miscarry, is a graver offence than if she be not quick with child.¹ Hence, in India, in these cases the question may arise, whether or no a certain female was "quick with child" at a particular time. (See 'Causing Miscarriage'.)

(6) *As motive in suicide and murder*

Cases.—**Pregnancy a motive for murder or suicide.**—(a) A widow seven months gone with child died rather suddenly, an inquest was held by the police, and a verdict returned of death from dysentery. Suspicion, however, being excited, a *post-mortem* examination was ordered, the result of which was the discovery of the pregnant condition of the woman (which had been concealed in the inquest report furnished by the police), and of the fact that the cause of death was arsenical poisoning. The district magistrate remarks, in reference to this case, that there is every reason to believe that all engaged in the inquest tried to conceal the true cause of death.—*Bo. Chem. An. Rep.* for 1884, reported by the District Magistrate of Basum, Hyderabad Assigned Districts.

(b) In this case, which occurred in the Surat district, as in above case, the cause of death was arsenical poisoning, and the deceased was a widow far gone in pregnancy. The brother and sister of the deceased confessed to having given her eight annas' worth of opium in order to procure abortion or to cause death, so as to avoid the disgrace arising out of her condition. No opium, however, could be discovered in the viscera of the deceased.—*Ibid*

(c) Alla Bux, of Purneah, was convicted of murdering his brother's

(d) *Case of poisoning by arsenic reported by medical officer, Tatta, Sind.*—"Deceased was promised in marriage to a man of her caste (Musulman), but before marriage she cohabited with him and became pregnant, and was advanced to above the fourth or fifth month, when her parents, to avoid disgrace, it is said, tried very much to procure abortion, but failed (much against her intended husband's will); so having failed to procure abortion, her parents, to save their reputation, it is suspected, gave her poison in her food."—*Bo. Chem. An. Rep.* 1876-77, p. 18.

Signs of Pregnancy.—These may be divided into—

(1) Probable and (2) Certain signs.

¹ *I. P. Code*, s. 312

Probable Signs.—(1) *Quickening.*—This obviously cannot be relied on for forensic purposes. Apart, however, from any wilful endeavour to deceive, a woman may be mistaken as to her condition. She may mistake, for example, symptoms of organic disease for symptoms of pregnancy. Cases are also recorded where, no organic disease being present, symptoms closely simulating those of pregnancy ('spurious pregnancy'), and, in exceptional cases, of labour also, have appeared. Again, a pregnant woman attributing her symptoms to disease, may be unaware of her condition, and remain so, even up to the time of her delivery. Further, as impregnation is independent of volition on the part of the female, conception may occur as the result of intercourse effected with her while in an insensible condition, and in such a case a woman may be unconscious of the fact that she is pregnant, and, it is possible, remain so up to the time of her delivery.

(2) *Cessation of*
fallacies. Menstrua
pregnancy A disch.
occur during pregnancy. Again, a woman may feign or deny menstruation in order to conceal her condition.

(3) *Morning sickness* is a common symptom, but it may, however, arise from causes other than pregnancy.

(4) *Changes in breasts.*—The breasts enlarge, become firmer, and secrete milk.

width from half an inch to
follicles, develops around it
however, arise from causes other than pregnancy, or may continue after delivery. Hence they may be present in a non-pregnant female. Again they may be absent in pregnancy.

(5) *Enlargement of abdomen and changes in uterus.*—The cervix becomes full, round, soft, and elastic, and the os loses its transverse shape, and becomes circular, and its edges become soft and indistinct. Up to the end of the third month, the uterus not having risen out of the pelvis, the cervix is low down in the vagina and easily reached, and no enlargement of the abdomen is perceptible. After this the uterus begins to rise, and the cervix to shorten, recede, and become indistinct. About the end of the fourth month the enlarged uterus begins to be perceptible above the pubes, and rises to—between the pubes and umbilicus during the fifth month; the umbilicus during the sixth month; halfway between the umbilicus and the lower end of the sternum during the seventh month; and to the ensiform cartilage during the eighth month. As similar changes may take place owing to enlargement of the uterus from causes other than pregnancy, more reliance is to be placed

on their absence as a negative sign, than on their presence as a positive sign of pregnancy.

Certain Signs.—(1) *Passive movement of fatus (Ballotement)*—This sign is not available until the end of the fourth month. It consists in the detection of a solid body floating (in the liquor amni) in the uterus.

cervix. The other hand is steadily pressed on the abdomen over the uterus. A jerk upwards is then given with the fingers in the vagina, when a hard body will be felt to recede from, and in three or four seconds fall back on, the fingers. After the end of the sixth month this sign is rarely available, the fatus, from its bulk, not floating freely enough in the liquor amni. Care must be taken to keep the fingers in contact with the cervix, otherwise a movement of the uterus itself may be mistaken for the movement of the fatus within it.

(2) *Sounds of fetal heart.*—Thus, the most certain of the signs of pregnancy, is described as resembling the ticking of a watch heard through a pillow. The pulsations vary from one hundred and twenty to one hundred and sixty a minute, and are not synchronous with the mother's pulse. A double sound is heard at each pulsation.

The sounds are generally, but not always, in normal presentations heard about midway between the umbilicus and one or other of the anterior superior spines of the ilium; they seldom can be heard earlier than the end of the fifth month, and in every case should be heard after the seventh month. If detected, the existence of pregnancy is certain, but pregnancy may exist and the sounds not be detected (a) owing to the examination being made at too early a stage; (b) owing to the death of the fatus, or (c) owing to want of skill on the part of the auscultator. Ogston records a case where owing to ascites the sounds could not be detected by a skilled auscultator.

When any doubt exists it is always better to give the individual the benefit of the doubt. After death, the discovery of an ovum or fatus in the uterus is, of course, an unequivocal sign of the existence of pregnancy. For the characters of the ovum or fatus at various stages of gestation, see table, p. 286. The presence also of a corpus luteum in the ovary may afford corroborative evidence.

‘Quickening.’

The whole question of ‘Quickening’ as regards Indian Law is in relation to Section 312, Indian Penal Code.

The term '*quickening*' is applied to certain peculiar sensations experienced by the mother at a certain stage of pregnancy. These sensations are often accompanied by constitutional disturbance, and are popularly ascribed to the first perception by the mother of the movements of the fœtus. They are most probably due to this cause, perception of the movements probably first occurring when the uterus comes into contact with the abdominal wall. These sensations may be felt as early as the twelfth week, are generally first felt between the fourteenth and twenty-fourth week, but in pregnancy. A woman who has quickened. These two are derived from the word 'namely, 'living' Their use arises from the old popular belief that their occurrence denoted the first accession of life to the fœtus. As, however, a fœtus is actually alive from the moment of conception, two interpretations may be assigned to the word 'quick' when applied to a fœtus *in utero* (1) The more extended interpretation, namely, that the fœtus is alive, or (2) The more restricted interpretation, namely, that the mother has experienced the sensation known as quickening.

As regards the first of the two phrases in question, viz. "with child of a quick child," there appears to be no doubt but that this has always been used in law as if the more restricted meaning attached to the word 'quick.' Some doubt, however, has been thrown on the interpretation accepted by English legal authorities of the second phrase, viz. "quick with child," owing to the remarks made by Baron Gurney in the case of *R. v. Wycherley* (8 C & P. 262). In this case pregnancy having been pleaded in bar of execution, the jury of matrons were directed to try whether the prisoner was "quick with child or not." Subsequently Baron Gurney addressed a medical witness called to the assistance of the jury of matrons as follows: "Quick with child is having conceived, with quick child is when the child has quickened. Do you understand the distinction?" Baron Gurney, therefore, in the case directed the medical witness to take the expression "quick with child" as if the more extended meaning attached to the word 'quick.' This, however, is contra

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When, therefore, the question arises, is a certain woman "with child of a quick child" (or "quick with child"), what has to be determined is whether or not the woman has quickened. Quickening, however, is a sensation only felt by the mother. Still, if a medical man has, on examination, felt the actual movements of the fetus, he is justified in assuming that the mother has also felt them, and that therefore she has quickened. Should he be unable to detect the active movements of the fetus, he can only, in answer to the question, Has this woman quickened? state his opinion as to whether or no (1) The woman is pregnant, (2) The child is alive; and (3) The pregnancy has advanced to, or beyond, the stage at which the sensation of quickening is usually experienced; leaving it for the court to decide whether his answers do or do not amount to an affirmative answer to the question, Has this woman quickened? In giving an opinion on the last of the three above-mentioned points, a medical witness should bear in mind that quickening does not occur at any fixed period, it may occur at any time between the twelfth and twenty-fourth week. Further, it may be noted, that of the two cases in which the question of quickening arises, namely, the English case of pregnancy pleaded in bar of execution, and the Indian case of causing miscarriage; in the first the prisoner is benefited by being found "quick with child," while in the second a similar answer has the reverse effect.

The medical witness cannot say if the woman has felt quickening. She is the only competent witness to her own feelings. If, however, he (1) undoubtedly feels the movements of the child, (2) hears the foetal heart sounds, he is justified in saying she is pregnant of a quick, i.e. a living, child.¹ Otherwise he can only say (1) she is pregnant, (2) the pregnancy has reached the stage at or before which quickening usually takes place.

¹ Many women have never felt quickening in their pregnancies.

CHAPTER XIII.

BIRTH AND DELIVERY *re* INHERITANCE.

BIRTH or delivery is a more frequent medico-legal question than pregnancy. It arises when the right to inherit property or a title is in dispute. Thus when the succession is fixed in the male line to the exclusion of the female line, the question may arise, Of what sex is a certain individual? (See 'Sex,' p. 35) Again, as by law children born "without the shape of mankind" cannot inherit, the question may arise, Has this child "the shape of mankind"? More commonly are the cases where the right to inherit is disputed, on one or other of the following grounds:—(1) That the claimant is not a legitimate child; and with the medico-legal questions which arise in such a case, we may consider those which arise in 'affiliation' cases; (2) that, as in 'tenancy by courtesy' cases, a certain child was not born alive; (3) that the claimant is a supposititious child.

Legitimacy.

Children are either '**legitimate**' or '**illegitimate**,' which is also called '**bastard**.' Only legitimate children are regarded by law as the children of their father. These, therefore, possess certain rights which illegitimate children do not possess. According to the law of most countries, only such children are held to be legitimate as are either born or begotten during the existence of a valid marriage (lawful wedlock) between their parents. By the law of Scotland, however, children born before marriage become legitimate on the subsequent marriage of their parents. Further, according to the law of England, any child born or begotten during lawful wedlock is presumed to be legitimate until the contrary is shown; (a) by proof of the impotence of the alleged father of the child; or (b) by proof that the parties to the marriage had no access to each other at any time when the child could have been begotten. The presumption, as to legitimacy, of the law of India is embodied in s. 112 of the Indian Evidence Act, and is as follows: "The fact that any person was born during the continuance of a valid

marriage between his mother and any man, or within two hundred and eighty days after its dissolution, the mother remaining unmarried, shall be conclusive proof that he is the legitimate son of that man, unless it can be shown that the parties to the marriage had no access to each other at any time when he could have been begotten."

Access in Legitimacy Cases.—The courts in India would no doubt construe the 112th section of the Evidence Act in accordance with the English decisions. It will be noticed that the 112th section does not in terms refer to the presumption be in potent, but proof of such fact of 'access' in the sense in which it is used in the above section.

The English law on this subject is to be found in the answers given by the judges to questions put to them by the House of Lords in the *Banbury Peerage Case* (1 S & S., 153, A.D. 1811). The law, as then stated, was recognized in a subsequent case, in the House of Lords, in 1837 (*Morris v. Davis*, 5 Cl & F., p 163), and is as follows.—(1st) That when the husband and wife have opportunities of access, the presumption of legitimacy may be rebutted by circumstances inducing a contrary presumption (2nd) That non-access or non-generating access may be proved by means of such legal evidence as is admissible in every other case in which it is necessary to prove a physical fact (3rd) That after proof of sexual intercourse evidence will not be admitted, except to disprove the fact. (4th) That sexual intercourse is presumed, unless met by such evidence as satisfies those who are to decide that it did not take place.

is rebutted. In the case of *Aylesford v. Aylesford*, reported in the *Times* of July 3, 1885, the husband and wife were both living in London

(*Times*, July 29, 1885), there was no evidence where the husband was during the child's birth, and the child was not begotten. He, against his wife, brought evidence to prove the case negative, and, and, illegitimate.

In the case of *Rez v. Inhabitants of Mansfield* (1 Q. B. 444), the Court of Queen's Bench determined that the non-access of the husband might be proved by circumstances, "one of which," it was said, "certainly is adulterous intercourse between the husband or wife and another party." In that case the whole proof consisted only of that single fact, and it was held not sufficient to rebut the presumption. The parties, however,

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Legitimacy.

Children are either 'legitimate' or 'illegitimate,' which is also called 'bastard.' Only legitimate children are regarded by law as the children of their father. These, therefore, possess certain rights which illegitimate children do not possess. According to the law of most countries, only such children are held to be legitimate as are either born or begotten during the existence of a valid marriage (lawful wedlock) between their parents. By the law of Scotland, however, children born before marriage become legitimate on the subsequent marriage of their parents. Further, according to the law of England, any child born or begotten during lawful wedlock is presumed to be legitimate until the contrary is shown; (a) by proof of the impotence of the alleged father of the child; or (b) by proof that the parties to the marriage had no access to each other at any time when the child could have been begotten. The presumption, as to legitimacy, of the law of India is embodied in s. 112 of the Indian Evidence Act, and is as follows: "The fact that any person was born during the continuance of a valid

marriage between his mother and any man, or within two hundred and eighty days after its dissolution, the mother remaining unmarried, shall be conclusive proof that he is the legitimate son of that man, unless it can be shown that the parties to the marriage had no access to each other at any time when he could have been begotten."

Access in Legitimacy Cases.—The courts in India would no doubt construe the 112th section of the Evidence Act in accordance with the English decisions. It will be noticed that the 112th section does not in terms refer to the presumption being rebutted if the husband be impotent, but proof of such impotency would negative the fact of 'access' in the sense in which it is submitted the word is used in the above section.

The English law on this subject is to be found in the answers given by the judges to questions put to them by the House of Lords in the *Banbury Peerage Case* (1 S. & S., 155, A.D. 1811). The law, as then stated, was recognized in a subsequent case, in the House of Lords, in 1837 (*Morris v. Davis*, 5 Cl. & F., p. 163), and is as follows.—(1st) That when the husband and wife have opportunities of access, the presumption of legitimacy may be rebutted by circumstances inducing a contrary presumption. (2nd) That non-access or non-generating access may be proved by means of such legal evidence as is admissible in every other case in which it is necessary to prove a physical fact. (3rd) That after proof of sexual intercourse evidence will not be admitted, except to disprove the fact. (4th) That sexual intercourse is presumed, unless met by such evidence as satisfies those who are to decide that it did not take place.

By 'access' is meant sexual intercourse, and not such intercourse as is understood by being in the same place or in the same house (*Banbury Peerage Case*, *Morris v. Davis*). Although possibility of such access may be proved, yet if the court is satisfied, from legal evidence, that no sexual intercourse did take place, the presumption of legitimacy is rebutted. In the case of *Aylesford v. Aylesford*, reported in the *Times* of July 3, 1885, the husband and wife were both living in London

(*Times*, July 29, 1885), there was no evidence where the husband and wife could have been in divorce proceedings at the circumstances of the intercourse between the husband and wife, held the child to be illegitimate.

In the case of *Rex v. Inhabitants of Mansfield* (1 Q. B. 444), the Court of Queen's Bench determined that the non-access of the husband might be proved by circumstances, "one of which," it was said, "certainly is adulterous intercourse between the husband or wife and another party." In that case the whole proof consisted only of that single fact, and it was held not sufficient to rebut the presumption. The parties, however,

Hence, the legitimacy of a child may be disputed on either of two grounds, namely, (1) that the alleged father of the child is impotent, or (2) that the parties to the marriage had no access to each other at any time when the child could have been begotten. The following examples show the medico-legal questions which may arise when legitimacy is disputed on the second of these two grounds.

1. A husband on a certain date ceases to have access to his wife; after a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the interval between the last access of the husband and the birth of the child was greater than the utmost period to which gestation can be prolonged.

2. The parties to a marriage are proved, after a long period of separation, to have resumed access to each other on a certain date. After the lapse of a certain interval the wife is delivered of a child. In such a case the legitimacy of the child may be disputed, on the ground that the period intervening between the date of resumption of access and the date of the child's birth was so short, that the child must have been begotten before access was resumed. If in such a case the appearance of the child at birth indicates it to be a mature child, the question arises, What is the shortest natural period of gestation? or if the child is an immature child, what, judging from its appearance, was its uterine age at the time of its birth (see pp. 280-1)? Again, in such a case it may be alleged that the mere fact that the child was born alive and capable of being reared, proves that its uterine age at birth was greater than the interval which elapsed between resumption of access and birth, thus raising the question, What is the earliest period of gestation at which a 'viable' child can be born, i.e. one capable of living and being reared? Moreover, as a portion of the evidence bearing on the question of early viability is derived from cases where a viable child has been born a short time after a previous delivery, and as such cases may be accounted for by 'superfotation' (i.e. conception of a second ovum during gestation of a first), the further question arises, Is superfotation possible?

It may be here remarked that, as his wife's adultery is a ground on which a husband may claim a divorce, questions similar to those arising in cases of contested legitimacy may arise in suits for divorce. The question as to the degree of maturity of a child may also arise in cases where a child is

born soon after marriage, and where it is alleged that the parents must in consequence have had sexual intercourse before marriage, and are therefore of immoral character (see following case).

Case.—A viable child born one hundred and seventy four days after marriage. The Rev Mr Jardine was married on the 3rd of March, 1835, and on the 24th of August following his wife was delivered of a girl, who, supposing her to have been the fruit of sexual intercourse on the day of the marriage, was only one hundred and seventy-four days, or five calendar months and twenty-one days old. The infant, which was undoubtedly immature, though to what degree could not be determined, died on the 20th of March, 1836, having survived about seven months. On this Mr. Jardine's parishioners brought a charge of incontinency against him before the General Assembly of the Church of Scotland, alleging that he must have had intercourse with his wife before marriage. The main question in the case was —Was it possible that a child not more than one hundred and seventy-four days old at birth, could be maintained alive for seven months? The court found the charge 'not proven.'—The Jardine Case. *Guy, For. Med*, p. 127.

Affiliation cases.—Although illegitimate children are regarded by law as the sons of nobody, their father is bound to contribute towards their support until they have attained a certain age. Hence, a woman having been delivered of an illegitimate child, may appear before a court and claim that a certain individual, who she alleges is the father of her child, may be compelled to so contribute. Such cases are called 'affiliation cases,' and in them questions may arise similar to those arising in cases of contested legitimacy. In affiliation cases also the further question may arise, Can any opinion as to the paternity of the child be formed from its resemblance or non-resemblance to its alleged father?

Tenancy by courtesy.—By the common law of England, if a man survived his wife, and he had issue by her born alive, that might by possibility inherit the estate as her heir, the husband so surviving became entitled to an estate for the residue of his life in such lands and tenements of his wife as she was solely seised of in fee simple, or fee tail in possession. The husband, while in enjoyment of this estate, is called a tenant by the courtesy of England, or, more shortly, tenant by courtesy.¹

¹ Williams on Real Property, p. 274.

of life, however, a mere tremulous motion of the lips, for example (see

case of disputed right to tenancy by courtesy, it may be alleged in opposition to the claim, that the child, when born, was so immature that it could not possibly have manifested any sign of life after birth; the question may arise in these cases, What is the earliest period of gestation at which a child can be born capable after birth of manifesting signs of life?

Case—Proof of live birth in a tenancy by courtesy case.—The wife of the plaintiff, who was possessed of an estate in her own right, died after having given birth to a child. The child was supposed to have been born dead, and the estate was surrendered to the defendant, her heir. Ten years afterwards facts came to the knowledge of the plaintiff which led him to believe that the child was born alive, and that he had therefore wrongfully surrendered the estate. The evidence of live birth was as follows: it was proved that the accoucheur in attendance (who had died before the trial) had, an hour before the child was born, declared it to be alive, and ordered a warm bath to be prepared for it. Further, two women, who after the child was born placed it in the bath, swore that they twice saw a twitching or tremulous motion of the lips of the child. This motion of the lips was the only sign of life observed, but it was held sufficient to establish the fact of live birth.—*Fish v. Palmer*; Taylor, *Med Jur*, II. p. 207.

It is possible that a claim to be tenant by the courtesy might arise in India, as there are estates held in India subject to the English Law of Inheritance (see remarks of Mr. Justice Pontifex in case below). No such claim, however, could be made by any one whose marriage had taken place since the 31st of December, 1865, as s. 4 of the Indian Succession Act, 1865, enacts that no person shall by marriage acquire any interest in the property of the person whom he or she marries. That section, by s. 331, is not applicable to marriages contracted before the 1st January, 1866.

Case.—Tenancy by courtesy in India.—In this case the widow of an Armenian, married before the Dower Act 29 of 1839, was held to be entitled to dower out of her husband's lands. In the course of the argument, Pontifex, J. remarked: "It would take away from the mutuality of contract between husband and wife to hold that the widow is not entitled to dower as against a purchaser from her husband. The husband is entitled to an estate by the courtesy of his wife's lands."—*Sarkis v. Proscromoyce Douce*, I. L. R., 6 Cal., p. 701.

Supposititious children.—By a supposititious child is meant a child produced by a woman who avers it to be hers when it is not. In these cases the motive is generally to further an attempt either to extort money or to divert

¹ The Scotch courts require, in order to establish the fact, of live birth in civil cases, proof of commencement of respiration (Ogston, *Lect. on Med. Jur.*, p. 182). For crying as a proof of birth, see 'Infanticide,' Chap. XVI.

succession to property. A supposititious child may be one (1) produced by a woman who has never been delivered of a viable child, or (2) produced by a woman in substitution for a child of her own. In case (1), besides questions similar to those occurring in legitimacy cases, the following additional questions may arise: (a) Is this woman sterile? and (b) does this woman show signs of having been recently or previously delivered of a viable child? In case (2) it is very seldom that medical evidence can afford any assistance. In both cases, as in affiliation cases, the question of how far the paternity of a child can be inferred from its resemblance or non-resemblance to its alleged parents may also arise.

Case.—Slingsby baby, 1916.

Inheritance.

The chief medico-legal questions which may arise in cases of disputed right to inherit are: (1) Is a certain individual impotent or sterile? This question has already been considered (see 'Impotence and Sterility'). (2) What is the natural period of human gestation? (3) How far may this period be prolonged? (4) Is superfetation possible? (5) What is the earliest viable age? (6) What are the characters of children born at various periods of gestation? (7) How far may the paternity of a child be inferred from its resemblance or non-resemblance to its alleged parents? (8) Has this woman ever been delivered of a viable child?

The Average Period of Human Gestation?—The duration of
period
delivery.

a single coitus and delivery. Of these two methods the first cannot be relied upon to give precise results, because (a) menstruation may cease from causes other than pregnancy, or may continue after pregnancy has commenced; and (b) impregnation may occur at any period during the menstrual interval. The second method, the first, also cannot be relied upon because impregnation is not but may occur as long thereafter as the spermatozoa retain their vitality, which they may do for several days after emission. The duration of natural gestation appears to be not a fixed period, but one subject to variation within certain limits. Guy, for example, states that of fourteen authentic cases in the human subject, in which the duration was ascertained by reckoning from a single coitus, the minimum duration was

270, the maximum 293, and the average 284 days.¹ Again, Wharton and Stillé give a table of all the authentic cases of this kind in the human subject they have been able to collect.² Their table includes fifty-six cases, and shows a range of duration of from 260 to 296 days, with an average of 276 days.

The view that the duration of pregnancy is not a fixed period is supported by the results of observations on the lower animals. Thus from three series of observations on cows, the minimum period in these appears to be 241 days, and the average period 280 to 285 days but in one series³ (160 animals) a period of 308 days was observed; in the second series⁴ (764 animals) a period of 313 days was noted; and in the third⁵ (1105 animals), in four delivery took place in the forty-eighth week, equal to a duration of over 329 days; and in one in the fifty-first week, equal to a duration of over 350 days. Again, a series of 102 observations on mares⁶ gave a range of 311 to 394 days, with an average of about 340 days; and another on 177 sheep,⁷ duration of 145 to 171 days, with an average of 150 days.

How long may Human Gestation be prolonged?—The chief considerations bearing on this question are as follows:—

1. Of the fifty six authentic cases collected by Wharton and Stillé, in which the duration of gestation was fixed from a single coitus, in nineteen the duration was over 280 days, and in two of these it was 291, and in three others 290 days.

2. In exceptional cases, where the commencement of pregnancy has

3. In a very large number of cases recorded by various authorities, in which the duration of pregnancy was estimated from the last day of menstruation, the longest period recorded was 325 or 326 days. As, however, conception may occur at almost any period during a menstrual interval, these cases cannot be relied on as showing anything more than that pregnancy may be prolonged for 325 or 326, less (say) 23 days. This would give 303 days, or a shorter period than in Hewitt's case. In four less certain cases of the same kind, the estimated period of gestation was 300 to 313 days (Simpson), and 311 and 321 days (Murphy).

4. In the lower animals it has been observed that the duration of pregnancy, as estimated from a single coitus, may be greatly protracted beyond the usual period.

¹ *Med. Jur.* (1884), III. p. 41.

² *See* Spencer's, *ibid.*

On the whole, therefore, as regards the question, What is the longest period which in natural human gestation may intervene between coitus and delivery?—the form which the question under consideration assumes for forensic purposes,—it may be stated that: (1) It may be regarded as proved that this may be 296 days. (2) Most authorities agree in considering that the interval may be as long as 44 weeks, or 308 days indeed, in the Gardner Peerage case, several eminent obstetricians gave it as their opinion that the interval might extend to, at any rate, 311 days.¹ (3) Some authorities consider that the interval may extend to the forty-sixth week, 315 to 322 days.²

Superfation.—It may be stated (1) that two closely following acts of intercourse in the same female may each prove fruitful (see case below), and (2) that it cannot be doubted but that conception may occur during pregnancy in cases where the uterus is double or bipartite, a rare condition in the human female, but still one of which several instances are recorded.

Case—Two closely following acts of intercourse in the same female; both prove fruitful.—“A female at Charleston, in South Carolina, was delivered in 1714 of twins within a very short time of each other. One was black and the other white. She confessed that on a particular day, immediately after her husband had left his bed, a negro entered her room, and by threatening to murder her had connection with her.”—*Guy's For. Med.*, p 132, one of several cases quoted by Beck.

Excluding these two classes of cases, and limiting the question to whether, the organs of the female being of normal formation, it is possible for a conception of a second embryo to occur during gestation, we find that authorities are divided in

CASES

1. *Physiological considerations.*—Those who deny the possibility of

Many cases are, however, reported showing that a dead fœtus may be

delivery of the other. Obviously, therefore, such cases do not support the view that superfœtation is possible.

(b) Cases in which a woman is delivered of two more or less mature children, a considerable interval, but still an interval shorter than the

ception of the two children occurred at the same time, but that the

case referred to by Taylor, in which the interval was 127 days (see also *Case* below, in which the interval was 167 days, but in which no sexual intercourse took place until twenty days after the first delivery).

Supposed superfœtation—The wife of Raymond Villard, of Lyons, eight months after a previous abortion at the seventh month, was delivered of the usual size of the child. The abdomen again felt thence five months and sixteen days after delivery she was again delivered of a living daughter. Both children were alive two years after the birth of the first child. "Dr. Desgranges, who attended the case, adds to his report that the second child could not have been conceived after delivery of the first, inasmuch as no sexual intercourse took place between the husband and wife until twenty days after the first delivery," or four months and twenty-seven days before the birth of the second child (Guy, p. 133).

"Marie Anne Biguad, æt. thirty-seven, gave birth on April 30, 1748, to a full-term mature boy, which survived its birth two and a half months, and to a second mature child (girl) on September 16, 1748, which lived one year. The interval between the two births was thus four and a half months (= one hundred and thirty-nine days). The mother, after her death, was proved not to have had a double uterus" (Tidy, *Leg. Med.*, II. p. 149, quoted from Naphey, 'Physical Life of Women,' p. 156).

Cases such as these involve the acceptance of one of three propositions, viz. either (1) That superfœtation is possible, even, as in the former case, when the uterus is not double; or (2) Supposing conception of the second child to have taken place after the birth of the first; that a viable child may

of the second child continues, until it also reaches maturity, when its birth takes place.

What is the earliest Viable Age?—What is the earliest period of gestation at which a child may be born alive, capable of living and being reared?—Here it may first be remarked (1) that there is no doubt but that a child born at or after the 210th day of uterine life may be reared; and (2) that the evidence afforded by recorded cases so strongly supports the view that children born as early as the 180th day may be reared, that the possibility of this cannot be denied. As regards the question of viability before the 180th day, it should be noted that the validity of the evidence afforded by cases cited to prove early viability mainly depends on the accuracy with which the date of conception is determined; for although the characters of a child at birth afford indications of its age, they cannot be relied on, except as corroborative evidence. In some of the cases cited as evidence of early viability, the date of conception is fixed from a previous delivery, *e.g.* the case mentioned by Taylor (see 'Superfœtation'), in which a viable child was born 127 days after a previous delivery, and another similar case referred to by the same author, in which the interval between the births was 174 days.¹ If we assume that in these cases conception of the second child did not take place until after the birth of the first, we must admit viability to be possible at respectively the 120th and 167th day of intra-uterine age cases such as these on the assumption of retardation of development, as suggested by Wharton and Stillé, to occur.

Of the cases in which the date of conception is fixed inde-

Guy, in reference to this case, says—"It is very valuable, for it is the only quite unequivocal instance on record of the rearing of a six-months child."² The Jardine case (*Case*, p. 275) is a very doubtfully authentic case of the rearing of a 174-day child.

¹ Taylor, *Med. Jur.*, II. 229.

² Guy's *For. Med.* (4th ed.), p. 136.

There are also a few less reliable cases of the rearing of children born at a period earlier than the 174th day.¹ Among these, the earliest visible age recorded in 133 days (Dr. Rodman's case).² The evidence afforded by these cases, in favour of viability at a period earlier than the 174th day, is further supported by certain recorded cases, in which children born at an earlier age than this lived for some days after birth.³

As regards the further question, What is the earliest age at which a child may be born, capable after its birth of showing signs of life? it may be stated, that there is more than one reliable case on record, showing that a child born between the fourth and fifth month of uterine life may after birth manifest signs of life. Among these may be mentioned Dr. Barrow's case of a child born at 144 days, which after birth breathed convulsively at intervals for forty minutes.⁴

After the fourth month the uterine age of the fœtus is indicated by the following characters. (A) During life.—(1) Its length and weight; (2) changes about the eyes; (3) the appearance of the skin, nails, and scalp hair, and (4) the position of the middle point of the body. (B) After death the following additional characters become available:—(1) The progress of ossification, (2) the condition of the intestines; (3) the condition of the gall-bladder; (4) the position of the testicles; and (5) miscellaneous characters. According to Guy, Tidy, and others, these characters are as follows —

1. The length and weight.—The table below gives the average length in inches, and average weight in pounds and ounces, at the end of each month.

Month	Length		Weight			
	in	in	lb	oz.	lb	oz.
4	4½	8½	0	3-0	7	
5	6½	10½	0	5-1	1	
6	8	13½	1	0-2	2	
7	11	16	2	0-4	5	
8	14	18	3	4-5	7	
9	16	20	4	5-7	0	

¹ E.g. Dr. Barker's case, 158 days (*Med. Times*, 1850, Vol. II. pp. 249, 392), and Capuron's doubtful case of Fortunio Laceta, 135 days (*Guy's For. Med.*, p. 129).

² *Guy's For. Med.*, p. 129.

³ E.g. Fleischmann's case of a child of 163 days living for eight days (*Guy's For. Med.*, p. 134), and Dr. Routh's case of a child born between the fifth and sixth month living for eighteen days after its birth (*Obstet. Trans.*, 1871, p. 182).

⁴ Wharton and Stillé, Vol. III. p. 51.

Exceptional cases are recorded of children at birth being unusually large and heavy. The greatest length and weight recorded appears to be 32 inches, and 18 lbs 1 oz., next to this comes a case where the length was 24 inches, and the weight 17 lbs. 12 oz.¹

2 **Changes about the eyes.**—The eyelids are adherent, and the membrana pupillaris vascular and distinctly visible up to the end of the sixth month. At the end of the sixth month, the eyebrows and eyelashes are beginning to form. At the end of the seventh month, the eyelids are non-adherent, and the membrana pupillaris is beginning to lose its vascularity, and by the end of the eighth month, it is so thin and transparent as to be only with difficulty discernible.

3 **Appearance of the skin, nails, and scalp hair.**—Up to the end of the fifth month the skin is destitute of fibrous structure and sebaceous covering. At the end of the sixth month, it begins to show a fibrous structure, and papillae begin to appear; at this period it is covered with down, and sebaceous matter begins to be visible on its surface. At the end of the seventh month, it is dusky red, thick, and fibrous, and

an inch.

4 **The position of the middle part of the body.**—This up to the end of the fifth month lies on the body of the sternum; gradually descending, it reaches the lower end of the sternum at the end of the sixth month, is nearer the umbilicus than the sternum at the end of the eighth month, and at the end of the ninth month is generally about three-quarters of an inch above the umbilicus.

FURTHER SIGNS AVAILABLE AFTER DEATH.

1 **Ossification.**—At the end of the fourth month the ossicles of the ear are found ossified, and points of ossification have just appeared in the upper part of the sacrum (for points of ossification appearing before the end of the third month, see table on page 269). By the end of the fifth month, points of ossification have appeared, in the pubis, os calcis, axis, and odontoid process; at the end of the sixth month, in the four divisions of the sternum; at the end of the seventh month, in the astragalus; at the end of the eighth month, in the last sacral vertebra; and at the end of the ninth month, in the lower epiphysis of the femur.

¹ Taylor, *Med. Jur.*, II. p. 314.

hymen may be taken as positive proof that the woman has never been delivered of a nearly mature child. Obviously, however, no conclusions can be drawn from the absence of the signs of virginity.

If the signs of recent delivery and virginity are both absent, the other chief signs to be looked for are:—

1 **Presence or absence of the lineæ albicantes** and condition of the breasts.—The presence of the lineæ and albicantes may, however, be accounted for by causes other than delivery, *e.g.* ovarian tumours, or ascites; and they may be absent in women who have been more than once delivered.¹ Enlargement of the breasts also may be the result of causes other than pregnancy.

2 **The condition of the posterior commissure.**—This, if ruptured, strongly indicates a previous delivery. If intact, the indication is strong that the woman has never been delivered of a child, and still more strong that she has never been delivered of a mature child.²

3 **The condition of the uterus.**—After delivery, the uterus does not wholly return to its original condition. The chief changes observable are as follows:—

(a) Its cavity becomes larger. According to Dr. Barnes,³ the vertical diameter of the cavity is, in virgins 1·80, in women 2·20, and in mothers 2·44 inches, and the transverse diameter of the cavity, in virgins 0·90, in women 1·08, and in mothers 1·24 inches.

On the whole, although the conditions of the uterus may be an indication of a previous delivery, no absolutely certain conclusion can be drawn from its state.

The question, "Has this woman ever been delivered of a child?" may also arise in *defamation* cases, and in cases of *disputed identity*. In the trial for murder, *ex post facto*, *Wright*, cited below, this question arose with reference to the identity of the remains discovered and alleged to be those of a certain female who was missing. From the evidence given by Dr. Meadows in this case, it would appear that

¹ Taylor, *Med. Jur.*, II, p. 162.

² *Dis. of Women*, p. 122.

³ *Id.*, p. 122.

EXTERNAL CHARACTERS OF THE FETUS AT THE END OF EACH MONTH OF UTERINE LIFE

Month	4	5	6	7	8	9
Average length in inches Mean weight (Gm)	6½ 5 ozs	8½ 11 ozs.	14 2 lbs 2 ozs.	15 3 lbs. 8 ozs	17 4 lbs 5 ozs	19½ 6 lbs 8 ozs
Skin	No sebaceous covering or fibrous structure apparent		Fibrous structure, papillae and sebaceous matter beginning to appear covered with down	Dusky red, thick and fibrous, and covered with sebaceous matter	Covered with fine short hairs and sebaceous matter	Down almost all disappeared; covered with sebaceous matter
Nails	Appearing	Very distinct	Growing	Do not quite reach to end of fingers	Reach to end of fingers	
Hair on scalp	None	Appearing	Distinct	About a quarter of an inch long	Over a quarter of an inch long	About one inch long
Eyes, etc.	Lids adherent, membrana pupillaris distinct	Membrana pupillaris distinct	Lids adherent: membrana pupillaris distinct; eyebrows and eyelashes beginning	Lids non-adherent; membrana pupillaris getting indistinct	Membrana pupillaris hardly visible	
Position of middle point of body	On sternum	On sternum	At lower end of sternum	Below lower end of sternum	Nearer umbilicus than sternum	Just above the umbilicus

CHAPTER XIV.

RAPE.

(See also Chap. XI on 'Virginity and Defloration.')

THE crime of rape is a felony punishable by imprisonment up to penal servitude for life, and formerly it was punished by castration and death. As it is usually committed in the absence of witnesses the law admits the testimony of the alleged victim, but the medical evidence is essential, as a large proportion of the accusations are false charges.

Definition of Rape.—According to the law of India (*I. P. C.*, s. 375, and also according to that of England¹), rape, subject to certain explanations detailed below, may be defined as sexual intercourse by a man with—(1) any female (including his own wife) under the age, in India, of twelve² (in England it is thirteen), or (2) any female over the above-stated age, not being the man's own wife—(a) against her will, or (b) without her free consent, or (c) even with her consent, when this has been obtained in certain unlawful ways. The explanations above referred to are.—

Degree of penetration necessary to constitute 'Rape.'—In India, the rule on this point is laid down in the explanation attached to s. 375 of the Penal Code as follows:—"Penetration is sufficient to constitute the sexual intercourse necessary to the offence of rape," and in the case of *Reg. v. Ferroll* (Bombay High Court Sessions, February, 1879), Green, J., directed the jury that *vulval penetration only* was sufficient, under the

no injury to the parts. The child was found to be suffering from gonorrhœa, so was the prisoner. It was clear that the penetration (if any) had been only vulval. Green, J., directed the jury that this was sufficient to constitute rape, and the prisoner was convicted of rape.—*Reg. v. Ferroll*, Bombay High Court Sessions, February, 1879.

¹ Criminal Law Amendment Act, 1885 (48 & 49 Vict. c. 69, s. 4)

² Act X. of 1891, s. 1.

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¹ *Criminal Law Amendment Act*, 1885 (48 & 49 Vict. c. 69, s. 4)

² Act X of 1891, s. 1

Age of the Male accused.—As already pointed out, it is an irrebuttable presumption of English law that a boy under the age of fourteen is incapable of committing rape. In England, therefore, a boy under the age of fourteen cannot be convicted of this offence. The criminal law of India contains no special presumption as to the age at which a boy attains potency and becomes capable of committing rape. It, however, contains

acts if he has attained (I.P.C. s. 375). A boy under the age of fourteen with rape does not. The question of the age of the accused is left to the court to decide according to the evidence produced in the case. Thus, "in the case, *Kurram Noorbai v. Meera Noorbai* (2 N. I. Rep., p. 87), a boy of ten years was convicted for rape by the Court of Sessions, but the Nizamut Adawlut, considering it undesirable to admit his capability, viewed the matter only as an attempt."—O'Kincaly's *Penal Code*, p. 177.

Age of consent in Female.—In Indian law sexual intercourse with

for her injury and acceptable amends usually terminate the prosecution.

Consent of the Female is invalid under the following circumstances:—In Indian law consent of a female to sexual intercourse is not valid, and does not exculpate the accused, if the manner in which it has

(3) If her consent has been obtained by putting her in fear of death or hurt (s. 375). (4) When the man impersonates her husband, and her consent is given because she believes that he is another man to whom she is, or believes herself to be, lawfully married (s. 375). Regarding these exceptions it may be noted:—(1) That, as regards exception 1, a female, for her consent to be valid, must be aware that the act to which she consents is sexual intercourse. On this point the law of England

¹ Confer p. 41. By *Criminal Law Amendment Act*, 1885, s. 5, imprisonment with or without hard labour not exceeding two years may be imposed

² In the United States of America the age of consent is 18.

agrees with that of India (see *Case*, below). (2) That, as regards exception 2, the law of England appears to differ somewhat from that of India, it having been decided in the case of *R v. Fletcher*,¹ in which a man was charged with rape on an idiot, that "a consent resulting from a mere animal instinct would suffice to prevent the act from constituting a rape." By s 5 of 48 & 49 Vict. c. 69, however, sexual intercourse with "any

imbecile," is a misdemeanour punishable less severely than rape. (3) That the law of England agrees with that of India in regard to exception 3. (4) That, as regards exception 4, it was ruled in *R. v. Barrow* (L. R. 1 C. C. R., p. 156), that this is not rape by English law. Since then, however, it has been enacted that a man who "induces a married woman to permit him to have connection with her by personating her husband" is guilty of rape (*Criminal Law Amendment Act*, 48 & 49 Vict. c. 69, s. 4).

Case.—Conviction for rape where consent was given under misconception of fact. From Tidy's *Leg. Med.*, II p. 244, *R v. Hattery*, L. R. 2 Q. B. D., p. 140—"The prisoner, a quack-doctor, professed to give medical and surgical advice for money. The prosecutrix, a girl of nineteen, consulted him with respect to an illness from which she was suffering. He advised that a surgical operation should be performed, and under the pretence of performing it had carnal connection with the prosecutrix. She submitted to what was done, not with any intention that he would have carnal connection with her, but under the belief that he was merely treating her medically, and performing a surgical operation, that belief being wilfully and fraudulently induced by the prisoner. The Court were unanimously of opinion that these facts constituted the crime of rape."

Cases of females compelling young boys to have intercourse with them are recorded by Chevers and Powell as having occurred in India, in which young boys had, under compulsion, intercourse with their *ayaks* or other females. Cases of this description, however, do not come under the definition of 'rape' laid down in the Indian Penal Code.

Under the penal code of France, it is an offence for a woman to attempt sexual intercourse, with or without consent, with a boy under the age of eleven.

Age of Victim.—Young children are more frequently raped than adult women, as they are less capable of offering resistance, and as in India the practice of infant marriage creates a desire for intercourse with immature girls. Besides an occasional motive for the rape is the old-world superstition, common both to India and Europe, that intercourse with a virgin is a cure for venereal disease, and the younger the girl the greater the probability of her being a virgin. The child-wives of India are still, to a large extent, the victims of rape

¹ L. R., 1 C. C. R., p. 22; Tidy, *Leg. Med.*, II. p. 194.

at the instance of their intemperate husbands, notwithstanding the Act of 1891 which raised the nubile age from ten to twelve years. For there is reason to believe that premenstrual congress with children is still largely practised in this country under the cover of marriage.

The age in 203 cases of proved rape in Bengal during the three years 1871-73 there was one 2 years old, one 2½, one 3, three 4, five 5, nine 6, nine 7, eighteen 8, twenty-one 9, twenty-six 10, nineteen 11, twenty 12, thirty between 12 and 15, and only nineteen above 15. That is to say, 51 per cent. were under 10 and 83 per cent. under 15 years of age. In the year 1868 of 48 cases in Bengal in two the age was 5, in seventeen between 6 and 10, in ten between 11 and 15, in seven between 16 and 20, in three above 20 and in nine not stated—that is to say, about half of the victims were under 10 years of age, and in most of the cases the children were badly hurt.

QUESTIONS IN RAPE CASES.

1 Can a man unaided commit a rape on an adult female of ordinary strength, in full possession of her senses?—It has been alleged that this is impossible. That, however, in exceptional cases, rape may be committed under the circumstances stated, is shown by the case below, reported by Casper, who, in regard to it, remarks: "The interest of this important case cannot be mistaken, for it shows that a healthy, powerful woman was certainly completely violated by a single man."¹ Ogston also, in reference to this question, remarks that the arguments advanced against the possibility of intercourse under the circumstances stated, "apply rather to the case of entire penetration of the vulva, than to the partial entry, which is now admitted in law as amounting to the crime of rape. That such entry may be forced in an ordinary case, I had the assurance of actual fact in at least one serious case."² Chevers, again, gives two cases in which rape was effected by unaided single men on adult females. Of course, the younger and

of offering sufficient resistance. Chevers mentions a case in which a man committed a rape on a woman of seventy.

Case.—Rape by one man unaided on an adult female (from Casper's *Handbook*, Vol. III, p. 311).—"I, persuaded F., a girl aged twenty five, to accompany him to the Tiergarten in the dark, and after he had been baulked by her struggles in his endeavours to violate her against a tree, he seized her round the body and flung her on the ground, and being now, as she states, deprived of the power of resistance, he flung her dress over her head and violated her. Nine days subsequently I had to

¹ Casper, III, p. 311.

² *Lect. Med. Jur.*, p. 120.

examine her. She was deeply moved by what had befallen her. The entrance to the vagina was still reddened, and painful when touched and dilated, the hymen was completely torn, and bright red; carunculae, still slightly swollen, were visible, the frænulum still existed. Without

in such a case, I came to the conclusion that a rape had actually been committed upon F. At the time of the trial, circumstances came out which only served to confirm this opinion. The police-officers who had hurried up at the cries of F. testified that the ground upon which she had been thrown was hard frozen, and they deposed that L., when arrested, and after his lust had been satisfied, was still in a condition of actual satyriasis."

Case.—Rape by one man unaided on a married girl *æ.t.* sixteen.—Fadil

2. Can a woman during sleep be violated without her knowledge?—A woman can undoubtedly be violated without her knowledge while under the influence of narcotics (anæsthetics, also alcohol), or during syncope or coma; and it has been alleged, with reasonable possibility, during mesmeric trance (see *Case* below). It is probable also that, in exceptional cases, a woman accustomed to sexual intercourse may be violated during profound natural sleep. Guy, in support of this view, mentions the case of a woman who, in illustration of a symptom which somewhat alarmed her—viz. that her sleep was unnaturally heavy—told him that her husband had assured her that he had frequently had connection with her during sleep.¹ On the other hand, it is highly improbable that a virgin could, during natural sleep, be violated without her knowledge, or even that, without her knowledge, sexual intercourse sufficient to constitute rape could be effected with her. Cases are reported where it is alleged that this has occurred (see *Cases* below); but it may be: "Non omnes dormiunt qui clausos habent oculos!"

Case.—Alleged
eighteen) consulted . . .
visited him daily for . . .
discovered that she . . .

¹ *For. Med.*, 4th ed., p. 57.

... further back than four and a half months, and founding their opinion
that,
sexual

consequently without
her. This opinion was

de Paris, and *Edin Month Jour*, December, 1860, p. 566)

Case — Alleged violation during profound natural sleep.—A servant woman at an hotel in Nenagh proved pregnant, and solemnly declared that she was not conscious of having had intercourse with any man. Suspicion, however, fell upon an ostler in the establishment, who

without her knowledge, as she did not evince the slightest consciousness of the act at the time, or recollection of its occurrence afterwards. The parties were married with mutual consent.—*Ogston, Med. Jur. Lect.*, p. 121.

Case — Another case.—Casper met with a solitary case in which a girl, at sixteen, accused a man of having had intercourse with her while

but presented lacerations in two places. This and other facts showed that there had been intercourse, but this did not prove that this had taken place without the consciousness of the woman.—*Taylor, Med. Jur.*, II p. 445.

3. May pregnancy follow rape?—It was formerly alleged that pregnancy never followed rape, and that hence if a woman charged a man with committing a rape upon her, and became pregnant as a result thereof, the charge must be untrue, and the woman must have consented to the intercourse. Impregnation is, however, independent of volition on the part of the female, and hence pregnancy, as is proved by more than one recorded case, may undoubtedly follow rape.

4. May rape cause death?—The introduction of the mature male organ into the vagina of an immature female may produce local injury sufficient to cause death from hæmorrhage, shock, or subsequent inflammation, such as peritonitis or gangrene, by violent laceration of vagina or perinæum. Such a cause of death was not uncommon amongst the child-wives in

Bengal up till at least 1890, when a notorious case (see below) attracted medical notice, and led to the Act raising the nubile age from ten to twelve. Even now cases of this kind doubtless happen not unfrequently and are concealed, the death being attributed to other causes. Chevers mentions 14 cases of death from this cause, and Harvoy¹ records that in Bengal, in the three years ending 1873, out of the 205 cases of rape which were proved, in 24 of these laceration of the vagina, generally of the posterior wall, was found; and in 14 the perinæum was torn, the rent varying from one-fifth of an inch to one inch in length. Five of these cases terminated fatally (see also *Case* below). Injury to the genitals of a young female may, however, be caused in order to support a false charge (see *Case*, p. 300). Violent sexual intercourse in a young female at or near the age of puberty, may cause constitutional disturbance, leading to fatal hæmorrhage into the brain, peritoneal cavity, etc. On the question whether death may result from nervous exhaustion, the result of repeated intercourse, Chevers cites the case of certain Marquesan women, who boasted, apparently with truth, of having had intercourse with one hundred men in one night. The intercourse, however, was voluntary; had it been otherwise, no doubt the exhaustion would have been greater.

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The mucous surfaces and internal organs were exsanguine; the uterus was infantile, and ovaries showed no sign of active ovulation. There was no sign of injury of the labia or vulva, and no trace of hymen. These circumstances were held to indicate that sexual intercourse, more or less complete, had taken place on previous occasions. The wall of the vagina was thin and showed no *rugæ*. The evidence in this case clearly established the fact that the fatal injury was caused by the sexual inter-

Mitchell, I. L. R., 18 Cal. 49; *J. Wilson*, July, 1890.

¹ *Bengal Med. Leg. Rep.*, 1870-72, pp. 179 et seq.

Case—**Death following rape.** Rape on a female *et am.* Death from hæmorrhage from a wound on the genitals ascribed to the introduction of the male organ. The left wall of the vagina was ruptured from the orifice upwards for 2½ inches, and the rent was an inch wide.—*Ind. Med. Gaz.*, November, 1875.

On the other hand, it has been held to be physically impossible that a girl of tender age should be killed by any violence in rape, and not show external signs of violence (*Queen v. Dancer M. Mookerjee*, 1 W. R. 29, November 22, 1864).

Rape on the dead.—It is necessary to find in such cases whether the female died from assault combined with rape, or was violated afterwards. The direction of the flow of blood will give indications. In cases of young children it is probable that rape was first committed and murder afterwards. In older females it is probable that they were murdered first and violated afterwards.

Cases—**Rape on Dead.**—(a) *R. v. Kerr.* Charged with rape on woman whose death was not from injuries produced, but from suffocation by vomited matter entering larynx by the violence offered. Locally there were two lacerations in vagina in addition to excoriation of abdomen and blood on the external genitals. The most conclusive *circumstantial evidence* was the *knives of the prisoner's trousers* were soiled with mud corresponding to that of the place where the assault was committed, and adherent to them was some red-coloured woollen fibre resembling that of the fabric of the woman's petticoat. Although prisoner averred that the woman consented he was found guilty.—*Carlisle Summer Assizes*, 1889.

(b) *St. Ayr Case.*—Female killed first and raped afterwards.—*Sir Jas. Stephens, Crim. Law of England*, 345 f.

(c) *Léotade Case.*—The body of the girl bore marks of a violent attempt at rape which was unsuccessful because the girl was not mature. In addition was violence to her head by a broad, blunt instrument.—*Id.*, 318 f.

(d) **Rape with Murder.**—A lad of Benares, who stated himself to be eighteen, but who appeared to be fourteen or fifteen years old, confessed at the *thannah* and magistrate's court that he had carnal knowledge of a child of seven, had caused her death in so doing, and had stolen her ornaments. The body was found concealed in a room, much decomposed, with a stone on the chest, and a cloth wrapped round the neck. Dr. Lockie, on removing the cloth, found that the whole of the soft parts of the neck had been destroyed, from which he inferred that it had been compressed, and that strangulation was the probable cause of the death.—*Niz. Ad. Reports*, N. W. P., June, 1853.

EXAMINATION IN RAPE CASES.

As neither the complainant nor accused can be compelled by a magistrate or any one else to submit to being examined

(without being guilty of and running the risk of a charge for indecent assault), the medical man must invariably, and in the presence of witnesses, obtain the *consent* of the person in question to make his examination, and at the same time caution the persons that the results of the examination may be used as evidence against them. Where the victim is under age, the consent of the nearest guardian should be asked. If a woman refuses to be examined it is probable that no rape has been committed.

The examination will comprise. (1) Examination of the victim or complainant, (2) The accused, and (3) Stained linen worn by the parties at the time, and (4) The spot where alleged crime was committed.

Examination of the Victim.

Having obtained her consent, and in the presence of a third person in order to avoid false charges being brought against you, commence in a good light, to make your examination; after note down in writing the following points¹:—

Preliminary Examination:—

- | | |
|--|--|
| 1. Date and exact hour at which she visits you | 1. With reference to lapse of time since alleged rape. If long delayed, why? as traces may disappear in 3 or 4 days. |
| 2. Her walk and mental state | 2. Referring to pain, emotional state, alcohol, etc |
| 3. Who accompanies her, and their attitude towards accused | 3 Referring to concocted tales. |
| 4. Her statements | |
| (1) Age. | |
| (2) Date, time and place of alleged offence. | |
| (3) Exact position of parties, sitting, standing, etc. | |
| (4) Did she cry out or struggle? | 4 Screaming out does not necessarily imply want of consent when it is done only when discovered by a third party in a compromising position. |
| (5) Was she sensible the whole time? | |
| (6) Menstruating or not. | |

Examination of her clothes.—Then let her be undressed, in such sections as are required, by some other person, and note if stains of blood, semen, mud, etc, are on her clothes. The clothes may be found torn or stained with blood, and

¹ Modified after F. T Smith, *Med. Jur.*, 192.

marks of blood may be found on the person. Of course, in such a case, the question will arise whether the blood is menstrual or not. As already pointed out, stains of menstrual blood cannot be distinguished from stains of other blood, by inquiry, however, it will have been ascertained whether or not the female was menstruating at the time of the alleged commission of the offence. If the female is seen soon after the alleged rape, the discharge from the vagina, if a discharge exists, or the vaginal mucus, should be examined for the presence of spermatozoa (see below). Spermatozoa may even be found in the vaginal mucus ten to fourteen days after rape. Stains containing spermatozoa may be found on the clothes; but it must always be recollected that the non-discovery of spermatozoa does not prove the absence of semen.

Seminal Stains.

The examination for seminal stains is made in connection with cases of rape and unnatural crime, though in neither of these is the detection of semen essential to the proving of the crime, for the actual emission of semen is not necessary for legal conviction.

Characters of the seminal stain :—(1) Semen stiffens cloth like starch, and is of a light greyish-yellow colour; pus and several other discharges stiffen cloth in a somewhat similar manner (2) The characteristic odour may be given out on moistening the stain, if the cloth is otherwise sufficiently clean (3) Presence of spermatozoa. This is the only positive and trustworthy test for semen, but it is essential that one or more should be seen in a complete form, with filament attached.

Mode of examination.—If taken direct from the vaginal mucus, a drop of the latter is placed on a slide and covered with a thin cover-glass and examined with a power of 300 to 400 diameters. If dried, as upon a garment or hair, the examination is more difficult, see below, also Hankin's method in Appendix IX., which is specially adapted for tropical conditions.

If the semen has dried on a fabric or on hair (the part of female underclothing most likely to contain semen are the back and front of inner garment over the genitals), the spermatozoa require to be softened and carefully separated without breaking from the material to which they have been glued down by the drying of their albuminous fluid. For this, the stain should be handled as little as possible and kept flat during the softening. A weak solution of hydrochloric acid, one drop to 44 c c (as recommended by Ungar), is the best softening solution to

this solution is put into a watch-glass, which latter is so placed that it is allowed to soak for a few minutes to several hours, according to the age of the stain. When the softening is complete, the fragment of cloth is removed by forceps and gently

a hemispherical portion which stains green while the anterior part and tail stain red

Characters of Spermatozoa.—These are minute bodies with an oval or pear-shaped transparent head (which strongly refracts light posteriorly) and a long slender tail. Human spermatozoa have a flattened, almost oval head, and vary in length from $\frac{1}{1000}$ to $\frac{1}{500}$ of an inch, the head being about $\frac{1}{1000}$ of an inch in diameter (see *Plate IV.*, Fig a). It is not easy to recover spermatozoa from stains on cloth even from spots of undoubted semen. Careful search should be made in several specimens of the

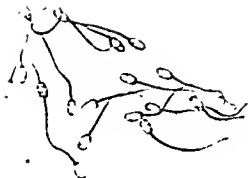
must not be mistaken for spermatozoa.

Characters of Vaginal Monad Animalcules.

Powell has found *Trichomonas vaginalis* in about one-third of the rape cases brought for medico-legal examination, when there is sufficient vaginal secretion to make a moist cover-glass preparation. He has kindly contributed the following important note of his methods.

edge of the undulant membrane. *There are no cilia as described by*

a



HUMAN SPERMATOZOA $\times 900$.

b



TRICHOMONAS VAGINALIS (Donné).

(Drawn from life by Prof. A. Powell.)

Scale |—————| = 16-22 μ .

[To face p. 226.

Donné and figured in Taylor's, Dixon Mann's and other text books. Sometimes a small notch or a kink in the undulant membrane may be seen close to the flagella. In this notch or mouth a particle of dirt or debris may lodge and give rise to the impression of cilia. The body is granular, of the same colour as the pus cells, possesses a nucleus and sometimes a vacuole like spot. Though fairly expert in the technique of fixing and staining Flagellates, I have never succeeded in staining one of these parasites. In a few cases I have found in the vagina a smaller monad $7-10\mu$ in diameter with only two flagella. The size of these monads, their granular appearance, the number of their flagella, the difficulty in staining, and the fact that they break up and are unrecognizable in dry smears must prevent any one mistaking them for spermatozoa."

Examination of her person.—Note her physical development, with reference to power of struggling, etc., and any bruises or scratches with reference to possibility of self-infliction.

Scratches, finger marks, bruises, or wounds, may be found on parts of the body other than the genitals, and the more the resistance offered the more likely are such marks to be found. Hence, therefore, such marks are likely to be more numerous if the subject is an adult female, and less numerous if a child. Even, however, in the case of an adult female, a rape may have been committed, and no such marks may be found. This may happen if the offence was committed while the female was insensible, or if several persons combined in the assault, some holding the female; or even where one man only has been concerned in committing the offence, when the woman has been nearly suffocated by her clothes being thrown over her head. Marks of violence employed to prevent the female crying out, may be found on the mouth or throat.

Sometimes violence employed for this purpose results in death from suffocation. Thus Chevers mentions a case where the husband of a young girl, in order to stifle her cries during first connection, bound a cloth over her mouth, and after intercourse found her to be dead.¹ In a case which came before the Bombay Chemical Analyser's office, it was reported that "deceased had been violated before death, and that the cause of death was suffocation, produced by the forcible introduction of earth into the mouth and windpipe."²

Then examine the genitalia for signs of loss of virginity and other injury or disease; noticing first the hairs on pubes, whether matted or stained, cutting off a portion of any such for microscopic examination; also whether any bruising, redness, or swelling of the *vulva* and any discharge from the *vagina*.

1. Signs of loss of virginity.—These are obviously only available as evidence of rape in cases where the female was *virgo intacta* previous to the commission of the offence. The hymen: as this is the most reliable sign of virginity, so rupture or laceration of this membrane is the chief sign of defloration

¹ *Med. Jur.*, p. 695

² *Tidy, Leg. Med.*, II, p. 200

available as evidence of rape, the various other signs of virginity being, as a rule, not lost as a consequence of one intercourse. Recent lacerations of the hymen are "sharp-edged, fresh-looking, and tender"¹; and when rupture of the hymen has recently occurred, the carunculæ myrtiformes are found swollen and tender; also in recent defloration, especially if due to rape, a hot pain in passing urine and fæces, accompanied by 1), may be present.

There may or may not be laceration of the fourchette.

Laceration or rupture of the hymen may, however, occur independently of sexual intercourse, viz. from the introduction of foreign bodies other than the penis. Rape, again, even in females over the age of puberty, may be unaccompanied by injury to the hymen; and, as already pointed out, in very young children the hymen is not usually even lacerated by sexual intercourse. On the whole, therefore, the presence of signs of recent injury to the hymen is to a certain extent evidence, but by no means conclusive evidence, in support of a charge of rape. The evidence, however, in favour of rape becomes stronger in proportion as the signs of local and other injury are greater. On the other hand, especially in young children, the absence of injury to the hymen cannot be taken as negating the supposition that rape has been committed.

2. Other injury to the genitals.—Rape by an adult on an immature female usually causes a considerable amount of local injury. The injury may amount simply to bruising, but frequently laceration of the parts results, and these lacerations may be extensive and severe enough to cause death. Severe injuries may be followed by inflammation and sloughing of the parts. Again, injuries to the genitals of immature females resembling those resulting from rape, have been caused by the introduction of foreign bodies other than the penis with the object of rendering them *aptæ viris*, or in order to support false charges (see *Case* below).

Case.—**Injury to the genitals of a young girl for the purpose of supporting a false accusation.**—A procuressa brought a girl into the officers' barrack, Fort William, Calcutta, but the person to whom she was presented objected to the girl on account of her youth. The bawd,

the officer to obtain money. The child recovered.—Chevers, *Med. Jur.*, p 701, from the *Med. Times and Gaz.*, May 21, 1859.

¹ Tidy, *Leg. Med.*, p 200.

In females who have reached puberty, laceration of the genitals may be found, if the disproportion between the size of the organs of the parties is great, or if much violence has been used. In adult females accustomed to sexual intercourse, lacerations are not likely to result from rape alone. Cases, however, are reported, where fatal laceration of the genitals has been produced in adult females after violation, by forcing foreign bodies such as sticks into the vagina. Bruises, scratches, and marks of violence, other than those caused by the introduction of the penis, may be found on the genitals, especially in adult females, but may be absent. On the whole, the presence of marks of local injury to the genitals is, to a certain extent, evidence in support of the supposition that rape has been committed. On the other hand—except when the subject is an adult female accustomed to sexual intercourse—the absence of such marks is strong, but not conclusive evidence against the same supposition.

3 Signs of infection with disease.—Many cases of rape by adults on young children owe their origin to a popular belief that sexual connection with a virgin is a cure for venereal disease; and there is no doubt that in this way female children are infected with gonorrhœa, a disease readily communicable to them. Ogston¹ mentions the case of a man who, while affected with gonorrhœa, had connection with four female children, communicating the disease to three of them. Female children, however, may become infected with gonorrhœa without intercourse. A case is recorded in which two girls, *æt.* respectively one and four years, became infected with the disease from using

discharge, arising from worms, etc., in dirty or delicate children, but it can be so distinguished (see *Case* below). Adult females are liable to leucorrhœa, which although usually a mucous discharge, may become, like gonorrhœa, mucopurulent owing to ulceration of the vagina. In adult females, also, it must be noted that the existence of syphilitic sores or of

¹ *Lect. Med. Jur.*, p. 96

² *Med. Gaz.*, Vol. XLVII. p. 144

gonorrhœa, only proves impure connection, not rape. The period of incubation of syphilis, or of gonorrhœa, may have an important bearing in a case of alleged rape. This in gonorrhœa varies from some hours to three or four to twelve days, and in syphilis from fourteen to forty-five or more days. Hence, if a female is seen within a few hours after an alleged rape has been committed, and is found to be suffering from a profuse discharge; or is seen within a few days, and is found to be suffering from syphilis; the presumption is strongly against the disease having been communicated during the intercourse represented as a rape. It should further be noted that infected individuals do not necessarily by intercourse communicate either gonorrhœa or syphilis.

Case—False charge of Rape.—"S., girl of 18, charged three hackney
fessed to have been
amination; I found
epresented by mere
later had any sign

of gonorrhœa."—Prof. Powell's *Reports*, 1917.

Cases—Dr Powell cites a case (*Ind Med. Gaz.*, 1902, p. 232) where he knew four men to have connection with a woman suffering from a copious gonorrhœal discharge, and only one was infected, and in another case out of seven troopers only two of them were infected. Mr. Hutchinson estimates that probably not once in a hundred acts of coition with a syphilitic partner is a chancre contracted.

In the case of rape on young children, however, there is greater likelihood of inoculation on the freshly torn surface.

The discharge should be examined microscopically with the requisite stains for the detection of the gonococcus of Neisser.¹

If the accused be suffering from gonorrhœa, the vagina of the complainant should certainly be searched for spermatozoa and gonorrhœal pus as soon as possible. Here, as recommended by Dr. A. Powell, a douche should be given, and a second examination for pus and gonococci made an hour or two later. If gonococci be now abundant, on the day of the alleged rape, they cannot be due to that act. A third examination should be made at the end of a week. If gonococci or the soft sore be now present, and had existed on the prisoner at the time of the rape, the evidence will be of value.

When examining for gonococci it is well to take two slides. One is stained with methyl blue, the other with aniline violet, and examined in xylol under a cover-glass. If preferred the Gram stained slide may

of gonococci may be examined in xylol under a cover-glass.

cells, spiral vessels, and other vegetable structures, as well as numerous ova of the thread-worm. The discharge from the vagina contains no spermatozoa, pus cells are numerous; there are no gonococci, many short bacilli of a colon type, a few staphylococci which all retain the stain after Gram's process. **OPINION.**—The child has what are usually considered the signs of virginity. I consider it impossible that a body as large as accused's penis could penetrate the hymen without tearing it. The child has a discharge from the private parts, but I am of opinion that it is not venereal in origin, as the germs usually found in gonorrhœa are absent. Similar discharges are said to frequently arise from the irritation of dirt or worms. There is evidence of the presence of numerous eggs of worms. The child is dirty, and has an eruption, such as would be caused on her thighs and blood. they are her private parts is a child accused was released.

Examination of the Accused.

This should ascertain.—(1) His age and capacity for committing the offence; (2) whether his clothes or person exhibit signs of recent sexual intercourse or a struggle; (3) whether he is suffering from venereal disease.

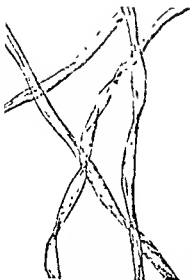
Age and potency.—This is ascertained as already described. As regards age whether he is under seven, or under twelve (p. 41), and as regards impotency see p. 252, also his muscular development.

Signs of recent intercourse.—Glans. If this be covered by uniform layer of *smegma*, it negatives the possibility of recent complete penetration. If not, any abrasions should be noted, especially on frænum.

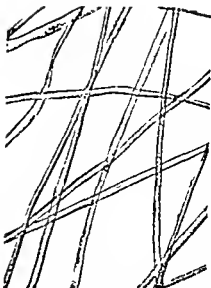
Stains on clothes or person.—The presence of *semen* on the clothes or person of accused is only evidence of recent emission and may have an innocent explanation, or have been in connection with another woman. **The presence of blood is important** if the alleged victim is a child or virgin; but the stains may have been removed by washing before your examination. It is of the utmost importance in rape cases that the police should not allow the accused person to retire to a water-closet on any pretext before the surgeon has made his examination.

Case.—Dr. A. Powell relates¹:—A menstruating woman accused a neighbour of rape. He was arrested in her room, but allowed by the police to wash himself. On examining him I found no trace of blood on his private parts. He quite frankly admitted intercourse, but with

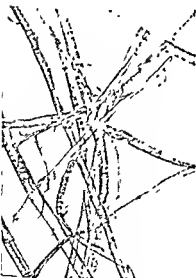
¹ *Ind. Med. Gaz.*, 1902, 231.



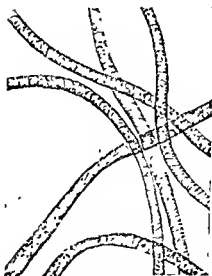
a.—COTTON FIBRE $\times 130$.



b.—SILK FIBRE $\times 130$



c.—LINEN FIBRE $\times 130$.



d.—SHEEP'S WOOL $\times 130$.

(From Micro Photographs by Dr H. Gibbs.)

[To face p. 304



consent. He stated the woman only cried out when some friends attempted to enter the room. He added that his penis and hand were covered with blood when arrested, and it was for this reason he went to the latrine and washed.

Stains of mud, etc., derived from the spot where offence is alleged to be committed should be looked for. Any scratches or bruises on his body should be noted with reference to a struggle.

Signs of venereal disease.—If the accused is suffering from venereal disease his discharge should be at once examined, and the character of the pus and any organisms therein compared with any found then or subsequently on the victim (see *Case*, p. 303), and at the same time the presence in it or absence of spermatozoa can be ascertained.

The Spot where the offence is alleged to have been committed may show signs of a struggle having taken place, or there may be blood-marks on it, or an impress of the body of the female on the ground.

CHAPTER XV.

CRIMINAL ABORTION OR MISCARRIAGE— FOETICIDE.

Criminal abortion or Foeticide is undoubtedly very prevalent in India, though only a relatively small proportion of the cases come into the law courts, usually those cases only where the results have proved fatal to the mother, as prosecutions are beset by obvious difficulties and convictions are extremely rare. Amongst Europeans in India cases often occur in medical practice where hæmorrhage, paralysis, and other symptoms are obviously due to the clandestine use of abortifacients. On the frequency of this dangerous and immoral practice amongst Europeans in India an experienced Anglo-Indian physician writes:—"I am afraid that in India inducements to procuring abortion criminally are frequent and strong, and I have known instances in which solicitations in that direction have caused medical men to swerve from the path of rectitude; but apart from considerations of personal reputation and professional honour, the blunt truth should never be forgotten that foeticide is murder, and, if fatal to the unfortunate mother, double murder."

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Accidental Miscarriage.

It occurs, and is more common in the earlier stages of pregnancy. Whitehead, from

observation of 2000 pregnancies, estimates that one in seven end in abortion. Dr Robert Barnes divides the causes of accidental or natural miscarriage into (1) Maternal, and (2) Foetal causes, and classifies them thus—

Maternal causes.—(1) Poisons circulating in the mother's blood: (a) introduced from without, as fevers, syphilis, various gases, lead, copper, etc.; (b) products of morbid action, as jaundice, albuminuria, carbonic acid from asphyxia, and in the moribund. (2) Diseases impoverishing the blood, *e.g.* anaemia, obstinate vomiting, over-lactation. (3) Circulatory disturbance, *e.g.* liver, heart, and lung disease. (4) Nervous troubles (a) certain nervous diseases, as chorea, etc., (b) mental shock, (c) diversion or exhaustion of nerve force, as from obstinate vomiting. (5) Local diseases (a) uterine diseases, as fibroid tumours, inflammation, hypertrophy, etc., of the uterine mucous membrane, (b) mechanical anomalies, as retroversion, pressure of tumours external to uterus, etc. (6) Artificially induced abortion.

Foetal causes.—(1) Diseases of the membranes of the ovum, *e.g.* fatty degeneration, hydatidiform degeneration, inflammation, congestion, apoplexy, and fibrous deposits. (2) Also diseases of embryo itself.—Malformation, inflammation of serous membranes, diseases of nervous system, diseases of kidneys, liver, etc., and mechanical, as from torsion of the cord.

Common causes of accidental miscarriage are syphilis, mental shock, and accidental violence. In some women miscarriage results from the slightest exciting cause. Others having once miscarried, miscarry in subsequent pregnancies apparently without any exciting cause. Others, again, seem "proof against the more severe physical injuries and suffering and the most violent mental excitement."¹

Case—Failure of external violence to cause miscarriage.—In the Assize Court of the Loire Inférieure it was proved that a peasant who

to her stomach bread just taken from a very hot oven. This means failed like the former, and the poor victim gave birth to a living and well-formed child at term.—Woodman and Tidy, *For. Med.*, p. 754, from Tardieu

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did not suffer in the least, and pretty much about the regular time a living child was brought into the world, without any marks of external injury upon it—Guy, *For. Med.*, p 87, quoting Dr. Wagner, of Berlin.

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Justifiable Miscarriage.

In defining the offence of causing miscarriage, s. 312 of the *I. P. Code* excepts as not criminal miscarriage caused "in good faith and for the purpose of saving the life of the woman." The law of England does not formally define under what circumstances it is lawful to cause miscarriage. Usually justifiable miscarriage takes the form of "artificial induction of premature labour," i.e. the operation is deferred until the child has attained viability, so that, if possible, its life as well as that of the mother may be saved. So long, however, as the operation is undertaken for the mother, miscarriage may be necessary to cause premature expulsion of the contents of the pregnant uterus in the following cases:—

(1) Pelvic distortion where the antero-posterior diameter of the pelvis (normally $4\frac{1}{2}$ inches at the brim and $4\frac{1}{2}$ inches in the cavity) is reduced below, or to, $3\frac{1}{2}$ inches. (2) Obstruction by the presence of tumours or contractions of the soft parts arising from cicatrices, of such a nature as to prevent the passage of a mature labour in "cases in which there is evidence that on several previous occasions the death of the fœtus occurred at a given time suddenly. Here," writes Meadows, "the operation would be resorted to

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Criminal Miscarriage.

Criminal abortion, or miscarriage, common in many countries, is especially common in India. It is resorted to by both single and married women in order to get rid of the product of illicit intercourse or to avoid inconvenient additions to their families. In India the custom of preventing the remarriage of widows tends directly to increase the prevalence of the offence. In India, in fact, in by far the great majority of cases of this offence, the female who has miscarried is a Hindu widow (see *Cases (a), (b)*, pp. 266–7) who resorts to this practice to avoid disgrace. Thus, however, is not invariably the case (see *Case (d)*, p. 268). This crime is also not uncommonly practised by European women in India, as already noted.

The sections of the *Indian Penal Code* concerning the offence of causing miscarriage are as follows.—

312. "Whoever voluntarily causes a woman with child to miscarry, shall if such miscarriage be not caused in good faith for the purpose of saving the life of the woman, be punished with imprisonment of either description for a term which may extend to three years, or with fine, or with both; and if the woman be quick with child, shall be punished with imprisonment of either description for a term which may extend to seven years, and shall also be liable to fine." "Explanation.—A woman who causes herself to miscarry is within the meaning of this section."

313. "Whoever commits the offence defined in the last preceding section without the consent of the woman, whether the woman is quick with child or not, shall be punished with transportation for life, or with imprisonment of either description which may extend to ten years, and shall also be liable to fine."

314. "Whoever with intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine; and if the act is done without the consent of the woman, shall be punished either with transportation for life, or with the punishment above mentioned." "Explanation.—It is not essential to this offence that the offender should know that the act is likely to cause death." [Unlike in English Law the question here arises of the consent of the woman.] Two other sections of the Code refer to results which may arise to the child from the doing of certain acts before its birth, namely, s. 315; and

316. "Whoever does any act under such circumstances that, if he thereby caused death, he would be guilty of culpable homicide, and does by such act cause the death of a quick unborn child, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine."

Attempts to cause miscarriage may be dealt with either by the application of the provisions of s. 511 of the Penal Code to ss. 312 or 313; or if the attempt has been made by the administration of an "unwholesome drug or other thing" the case may be dealt with under s. 323. Hence by the law of India to voluntarily cause or attempt to cause 'miscarriage,'

except in good faith for the purpose of saving the life of the woman, is an offence; proof of pregnancy, which is required to convict for causing miscarriage, is not required for an 'attempt.'

Further, supposing it to be proved that such an offence has been committed, the following additional questions are, owing to the wording of the above-quoted sections, liable to arise:— (1) Was the woman pregnant? Proof of pregnancy is required to secure a conviction for causing miscarriage, but not to secure conviction for an attempt. (2) Was the woman quick with child? (3) Was the miscarriage caused, or the attempt to cause it made, without the consent of the woman? (4) Did the woman's death result from the miscarriage or the attempt to cause it? And (5) In certain cases (see ss. 315 and 316) did the death of the child result from an act done before its birth?

In England, causing miscarriage is punishable by death or imprisonment under ss. 58 & 59 of 24 & 25 Vict. c. 100, as amended by 27 & 28 Vict. c. 47.

to procure the miscarriage of any woman, whether she be or be not with child, shall be guilty of misdemeanor, and being convicted thereof, shall be liable, at the discretion of the court, to be kept in penal servitude for the term of three years, or to be imprisoned for any term not exceed-

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2, the minimum term of penal servitude years. It may be noted that under

Proofs of an Abortion.

In investigating a case of alleged criminal miscarriage examination should be made of:—I. The means alleged to have been used. II. The substances alleged to have been expelled; and III. The woman alleged to have miscarried.

I.—Means alleged to have been used.

The methods of the criminal abortionist are usually of the crudest kind. Miscarriage may have been caused, or an attempt to cause it made, by (1) General violence; (2) Local violence, or (3) Administration of drugs.

(1) **GENERAL VIOLENCE.**

Blood-letting has, in some countries, a popular repute as a means of causing miscarriage. Bleeding from the foot, application of leeches to the anus or to the vulva, have all been resorted to. Blood-letting, however, usually fails, and the same may be said of the use of very hot or very cold baths. Violent exercise, such as hard riding; severe jolting, as driving over a rough road; violent shocks, as from blows or falls; and tight compression of the abdomen, may all cause abortion. Often severe general mechanical violence altogether fails (see above cases). Sometimes mechanical violence is combined with the administration of drugs (see following case).

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^a Values are means ± SD.

found that the screams proceeded from a woman who had aborted, and

became severe, the man who gave her the medicine seized hold of her hands and feet, and his wife pressed on her abdomen, with the result that abortion was effected.—*Bombay Chem. Analyst's Report*, 1884.

(2) LOCAL VIOLENCE (INCLUDING LOCAL APPLICATION).

Rupturing or separating the membranes, with or without dilation of the os; the insertion of a foreign body into the uterus; or the use of the vaginal douche; are the means of inducing premature labour commonly employed by medical practitioners. Similar means are often resorted to by unskilled persons in criminal attempts, and often fatal injury to the mother is the result.

In India a common method employed is the introduction into the vagina or uterus, of either a twig of some irritant plant, or a thin piece of stick armed with some irritant or reputed abortifacient preparation. The plants, twigs of which are most commonly used, are *Plumbago rosea* and *cydonica*.

(*Lal chitra*), and less frequently *Nerium odorum* (oleander), *Cerbera thevetia* (yellow oleander), and *Euphorbium tirucalli* (milk-bush). The twigs of these plants, previous to introduction, are often smeared with *asafœtida* (*Hing*). When a piece of stick armed with an irritant or other preparation is employed, the stick is commonly wrapped round at one end or for the greater portion of its length with cotton, and to this the preparation is applied. More or less common ingredients of the preparations employed for arming such sticks are, besides matters derived from the plants just named, the juice of *Jequirity* ('*rati*' *abrus precatorius*), *Calotropis procera* (*madar*), or the milky juice of various other *Euphorbias*, bruised marking-nuts (*semi-carpus unacardium*), arsenious oxide, orpiment, and red lead. This last (red lead), very commonly in Bombay, forms one of the ingredients of the composition employed.¹

Sometimes a mass of irritant paste is simply thrust into the upper part of the vagina. Not infrequently the twig or stick employed passes wholly into the uterus, causing fatal inflammation, and after death is found lying wholly or partly within the cavity of the emptied or unemptied uterus, perhaps transfixing its walls. Perforation of the uterine walls by such sticks or twigs may occur from force used in introducing them, or from subsequent contraction of the uterus upon them. Dr. Lyon was present in Bombay at a *post-mortem* examination on an abortion case, in which two thin pieces of stick were found lying side by side in the uterus across the fundus, both transfixing the uterine wall on either side. From their position, these sticks must have been (*a*) retained by the uterus after expulsion of its contents, and (*b*) forced through the uterine wall by the contractions of the uterus. Introduction of irritant twigs, or of sticks armed as described above, appears to be the method usually resorted to in India by practised abortionists, and very often proves successful. It should be noted that irritant substances are sometimes introduced into the vagina as a mode of torture. Dr. W. Gray met with a case in which a man placed three marking-nuts in his wife's vagina, as a punishment for infidelity.²

II.—Substances alleged to have been expelled from the Uterus.

(*a*) These may contain no ovum or embryo, *e.g.* they may be blood-clots, a fibroid tumour, a dysmenorrhœal false membrane, a mole, or hydatids. In India, in such a case, the

¹ See '*Lead Poisoning*.'

² *Icon Chem. Analyser's Rep.*, 1874-75.

accused can only be convicted of an attempt to cause miscarriage

In England, except the accused be the female alleged to have miscarried, the nature of the substances expelled from the uterus is immaterial.

(b) They may contain an ovum, embryo, or immature foetus.—As by the law of India causing miscarriage is punishable with greater severity if the woman be quick with child, it is important to determine the uterine age of an immature foetus found in the matters expelled. For the characters of the foetus at various periods of gestation, see p. 286. In criminal miscarriage, it may be noted, the usual period selected is during the fifth or sixth month.

Chevers, however, points out that women in India "not infrequently induce premature confinement when they have nearly advanced to their full period".¹ In giving, from examination of the foetus, an opinion as to whether quickening has occurred, it must be borne in mind that quickening does not take place at any fixed period. After ascertaining the probable uterine age of the fetus, the question of the cause and time of its death must next be considered. By the law of England, the fact that the death of the child resulted from criminal causing of miscarriage, only affects the gravity of the offence committed in one case, namely, where the child survives its complete birth. In such a case the offence committed is murder according to English law. This is not so in India. In India, however, in certain cases (see Penal Code, ss 315 and 316) the fact that the death of the child resulted renders the offender liable to enhanced punishment.

(c) What has been expelled may be a mature child.—In such a case it is of course possible that miscarriage has not occurred at all. When this is suspected, signs indicative of maturity should be carefully looked for. One of the most important of these, only available, however, if the child be dead, is the presence in the lower epiphysis of the femur of a point of ossification more than three-quarters of a line in width. Of course, in all cases where the degree of maturity of the child indicates that it might possibly have been born alive, the questions whether or no it survived its birth, and what was the cause of its death, must be inquired into, as in a case of alleged infanticide.

ADMINISTRATION OF DRUGS.

The substances popularly believed to possess abortifacient properties, may conveniently be arranged in five classes, namely, (a) Emetics; (b) Reputed Emmenagogues; (c) Purgatives; (d) Irritants; and (e) Other substances. The clandestine use

¹ *Med. Jur.*, p. 733.

of such abortives by married women, both native and European, may be the cause of apparent menorrhagia, dysentery, paralysis, etc.

(a) **Ecbolics**, i.e. substances which stimulate the contraction of the muscular fibres of the uterus. The only undoubtedly ecbolic drug known is ergot. Administration of this, after the uterus has begun to contract, nearly always increases the force and frequency of its contractions. When, however, contractions of the uterus have not commenced, administration of ergot may or may not excite their commencement. Apparently, the less advanced the pregnancy, the more likely is it to fail. Hence, when given with criminal intent, as is frequently the case in England, it often fails to cause abortion. Ergot has been stated to act injuriously on the child. Dr. U. West,¹ however, records that out of one hundred and seventy-two labours in which he gave ergot, only five still births resulted, or considerably less than the usual percentage of still to live births.² Borax has been stated to possess ecbolic action, but this is extremely doubtful. Cotton root bark is said to act on the uterus like ergot, and has been used as a substitute for it.³

(b) **Reputed emmenagogues**, i.e. substances believed to promote the menstrual flow. The principal substance of this class used criminally as an abortifacient, is Savin (*Juniperus sobina*). This is frequently employed in England, both in the form of powdered leaves (or a decoction made from them), and in the form of oil of savin. It often occasions abortion, but often fails. When given in large doses for the purpose of procuring abortion, it acts as a powerful irritant poison, and has in several cases caused death

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Less active or non-poisonous drugs of this class are:—Pennyroyal (*Mentha pulegium*). This has been used in England for the purpose of procuring abortion. Most authorities consider it to be without action on the uterus, and many do not even consider it to be a noxious

(c) **Purgatives**, especially such as cause much straining, or act powerfully on the rectum, may, if given in large doses, bring on abortion.

¹ Taylor, *Med. Jur.*, II., p. 192.

² Lauder Brunton's *Pharmacology*, p. 783.

³ Tidy, *Lec. Med.*, II., p. 169.

³ 5½ per cent.

⁴ Taylor, *Med. Jur.*, II., p. 183.

⁵ *Mat. Med. of W. India*, p. 295.

This effect is more likely to result in the advanced than in the earlier stages of pregnancy.

In India, various Cucurbitaceous tubers, namely *Cucumis trigonus* (Karis), *Momordica Charantia* (Kerale), and *Momordica Cymbalaria* (Kadaranchi) have been used, it is alleged, with success. Aloes, in the form of *Hirapura* (a mixture of powdered aloes and powdered cannella

with intent to excite abortion, caused death.¹ *Llatarium*, *Croton* oil, and Gamboge may also be classed as purgatives, likely, under certain circumstances, to cause abortion.

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in India; it has, in more than one case, caused death without producing abortion (see *Case (d)*, p. 266). (2) Iron; the sulphate and the tincture of the perchloride have been used in England; neither of the preparations appear to possess any specific abortifacient power. (3) Mercury; this has been used in England in the metallic form, and as calomel, but without success. Chevers mentions an Indian case where mercuric sulphide formed one of the ingredients of a powder given with intent to cause abortion.

Organic Irritants: *Plumbago* (*rosea* and *scylanica*), the juice of various *Euphorbias*, and the juice of the *Calotropis procera*, are all in more or less common use in India for internal administration as abortifacients. Chevers also mentions as similarly used black pepper, unripe pineapple, the bark of *Moringa pterygosperma* (horse-radish tree), and blistering flies. Copper and lead salts have been used. Quinine is very commonly used in India as an abortifacient and sometimes produces the desired result.

Case—Abortion by quinine. "A Eurasian woman in Bombay took five drachms of quinine as an abortifacient. Three days later she gave birth to a five-months fetus. She was for weeks in a very precarious

(e) Other substances.—Numerous other substances, none of which so far as known possess any specific abortifacient power, are mentioned by various writers as enjoying more or less popular repute as emetics.

In India, the juice of bamboo leaves; the fruit of *Randia dumetorum* (*Main-phal* or *Gela-phal*), an emetic recommended as a substitute for

¹ *On Poisons*, p. 522.

In Europe, squills, hellebore, and laburnum have all three been employed as abortifacients. So also have the following: sarsaparilla, guinea pepper (grains of paradise), saffron, guaiacum, horehound, camomile, wormwood, mugwort, and juniper.

III.—Examination of the Woman.

During life, traces left by the means employed may be found on the person of the female, *e.g.* bruises on the abdomen, marks of injury on the genitals, or foreign bodies in the vagina. If miscarriage has actually been caused, the signs of recent delivery may be present. These obviously are less marked, the earlier the period of gestation at which the miscarriage has taken place, and the longer the interval which has elapsed since it occurred. In a case no signs of an alleged abortion at three months were present seven days after the event; on the other hand, the same compiler (Harvey) mentions a case where relaxation of the genitals was found six or seven days after abortion at two to two and a quarter months, and another, where in a woman *at* twenty-two, eight days after abortion at four months, the following signs were found: vagina slightly dilated, puerperal smell distinct, the uterus could be felt through the abdominal wall, and a little milk could be squeezed from the breasts. In other cases signs sufficient to indicate abortion were reported to be present a fortnight to a month after the occurrence.¹

After death.—Further traces left by the means employed may be found, *e.g.* extravasation of blood underlying bruises, internal wounds, signs of irritation on the mucous membrane of the alimentary canal, presence of poisons, etc. In addition to the signs of recent delivery present during life, others become available, derived from examination of (1) the uterus, and (2) the ovaries.

1. The uterus.—This may be found enlarged, the enlargement being greater, the more advanced the period of gestation at which delivery took place, and the less the time which has elapsed since the event.

day or two after delivery a

4 inches, and its weight as 1 lb.

at the full term, it does not exceed 5 inches in length, and weighs about 1 lb. If delivery has taken place at five months, the uterus, according to the same authority, will be found

¹ *Bengal Med. Leg. Rep.*, 1870-72, p. 297.

immediately afterwards to measure $5\frac{1}{2}$ by $3\frac{1}{2}$ inches; and fourteen days afterwards, $4\frac{1}{2}$ by $2\frac{1}{2}$ inches. On internal examination within a few hours of delivery at the full term, coagula, or fluid tinged with blood, will be found in the cavity. At the seat of attachment of the placenta, the substance of the organ will be found exposed, showing large valvular openings. The inner surface is extremely dark, almost black in colour, and portions of the decidua, intermixed with flakes of lymph, adhere to it. These appearances also are less marked the earlier the period of gestation, and the longer the time which has elapsed since expulsion of the uterine contents. As already pointed out, twigs of irritant plants, or pieces of stick, may, in abortion cases, be found in the cavity of the uterus, or transfixing its walls.

2 **The ovaries.**—Ordinarily at each menstruation an ovum escapes from the ovary, leaving behind it a cicatrix called a corpus luteum. As a rule, this cicatrix undergoes a peculiar development during pregnancy; but does not undergo such development if the escape of the ovum is not followed by pregnancy. Hence corpora lutea are distinguished as true and false, meaning by a 'true corpus luteum,' the corpus luteum of pregnancy, and by a 'false corpus luteum,' the corpus luteum of the unimpregnated female. In some exceptional cases, the development of the cicatrix and its conversion into a body not distinguishable from a true corpus luteum, has been found to occur in the unimpregnated female; and *vice versa*, in other exceptional cases, no such developed cicatrix has been found in a pregnant female.

On this important matter Professor Powell has put the subject very clearly and concisely. He says: "At each menstrual period an ovum escapes from the ovary leaving the Graafian follicle distended with blood. If pregnancy does not follow, this blood becomes absorbed so that at the end of two months there is in most cases only a trifling scar to indicate its position. Should pregnancy, however, ensue, in most cases the wall of the follicle becomes thickened, convoluted, and of a yellow colour; the central clot becomes fibrinized and decolorized. At the ninth month the whole scar is usually about half an inch in diameter and has received the name, 'corpus luteum.'"

These changes are by no means constant in pregnancy and may take place in a virgin's ovary.

As they can only be found *post mortem* when more definite evidence of pregnancy can be obtained in the uterus, breasts, etc., their value as evidence is slight and unreliable.

Post mortem delivery.

In examining the dead body of a female alleged to have miscarried, the possibility of the occurrence of this accident must not be forgotten. *Post mortem* delivery, owing to the pressure of gases evolved during putrefaction, may occur after death at any period of gestation. It may or may not be accompanied by inversion of the uterus. Inversion even of the non-gravid uterus may occur from the same cause. In the Bengal Medico-legal Reports for the three years ending 1872, nine or ten cases of *post mortem* delivery are cited, and several of *post mortem* inversion of the non-gravid uterus were reported during this period. For a typical case of *post mortem* delivery, see the following —

grown male foetus, with the remains of the membranes, funis, and placenta, all continuous with each other, but detached from the uterus." No attempt to cause abortion had been made, and no signs indicating that any such attempt had been made, were to be seen.—Dr. Wright, Jaunpur, *Ind. Med. Gaz.*, 1887, p. 296.

CHAPTER XVI.

INFANTICIDE.

'INFANTICIDE' is a term popularly used to denote the murder or homicide of a newly born infant. The law, however, draws no such distinction, infanticide is homicide in law, and the provisions of the law which apply to homicide apply equally to infanticide. But although the law draws no distinction between infanticide and homicide, the subject of infanticide requires special consideration on account of (1) the frequency of the crime, and (2) the special questions which arise.

(1) Cause and Frequency.

Infanticide is common in almost all countries, the motive being

of female children.

As regards the first of these forms of infanticide, the motives leading to it in India are similar to those which lead to it in other countries. Its frequency in India is, however, specially affected by certain social customs, viz. (a) early marriage, which tends to diminish the frequency of the crime; and (b) prohibition, especially among higher caste Hindus, of widow remarriage, which tends to increase its frequency. As a consequence, therefore, while in European countries the accused is most frequently an unmarried female, in India the accused is very frequently a Hindu widow.

The second form of infanticide may be said to be special to the East.

a special Act for its repression,¹ and even now the crime is far from rare. Some idea of the extent to which it was practised may be found from the facts which came out in the course of an inquiry ordered by Government previous to the passing of the Act. It was found, for example, that

of the crime had been adopted, the result was to greatly increase the number of female children. In Mawpuri, for example, the number of Rajput girls rose in thirteen years from nil to 250, and in the Agra district the number of girls was doubled in a few years.

(2) Questions in Infanticide.

It has already been stated that the legal term 'homicide' means the destroying of a human being. According to the criminal law of England, an infant is not considered a human being until the moment it is completely born, *i.e.* completely and wholly external to the mother, irrespective of whether or no it be still attached to the mother by the umbilical cord. Hence, according to English law, the destruction of an infant before its complete birth has taken place is not homicide.

According to the law of India, however, so far as homicide is concerned, a child is "in being" from the moment "any part of that child has been brought forth, though the child may not have breathed or been completely born."² Hence, according to Indian law, killing an infant before any part of it is born is not homicide. Further, if the result of an act is to cause a child to die after its complete birth, the doing of the act is not punishable as culpable homicide. Section 315 of the Indian Penal Code states: "Whoever before the birth of any child does any act with the intention of thereby preventing that child from being born alive, or causing it to die after its birth,

¹ "if any part of that child has been brought forth, though the child may not have breathed or been completely born."—*I. P. Code*, s. 299, expl. 3.

no doubt but that such cases are extremely rare, and have only been known to occur under the special circumstances stated above. Obviously, also, a child may be heard to cry after the birth of the head and before complete birth; the question, however, whether or no the crying took place after partial, but before complete birth, would not be material in a case of alleged infanticide in India, although it might be so in an English case.

Case — Vagitus uterinus — "In 1834 Dr. Joubert was called to assist in the delivery of a woman with a deformed pelvis, who had had two abortions previously. After strong pains the membranes had ruptured forty-eight hours before his visit. On examining the woman he found

an obstacle to the descent of the head, the forceps was applied to it, when, at the moment the operator commenced his attempts at extraction, the

remains of the child were found by air present. — Ogleton, *Med. Jur.* vol. ii. p. 247

As a rule, however, in cases of alleged infanticide, the only evidence of live birth available is the opinion of an expert founded on *post mortem* examination of the body of the infant. In giving such an opinion the following points must be considered — (1) What is the degree of maturity of the child? (2) Does it show signs of having breathed? (3) Does it show any signs of live birth other than such as are directly due to the establishment of respiration? (4) Does it show signs of having been born dead?

THE DEGREE OF MATURITY OF THE CHILD.

In order to establish the fact that infanticide has been committed, the law (both of England and of India) requires it to be proved that the child was born alive; not that it was born 'viable' or capable of living and being reared. The degree of maturity of the child, however, is a factor which must be taken into account in framing an answer to the question, Did this child live after its birth? because the less the degree of maturity, the less the probability of live birth. Indeed, in the case of a child born before the 120th day of intra-uterine life the possibility of live birth may be altogether excluded. (For the characters whereby the degree of maturity can be ascertained, see p. 286.)

Does the child show signs of having breathed?—When respiration has been fully established certain changes will be found to have taken place in the lungs, viz. (1) they alter in appearance and feel, (2) they increase in weight; and (3) their specific gravity is lowered.

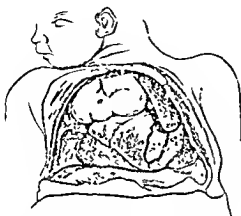


FIG. 20.—Infantile Lungs before breathing.¹

(1) Altered appearance, etc., of lungs :—

Before Respiration	After Respiration.
<p>Uniform dark liver colour.</p> <p>Solid, occupy only the upper dorsal part of the chest, leaving pericardium exposed.</p> <p>Not crepitant when handled or cut, and exude little blood on section.</p> <p>No inflated air vesicles visible, but possibly bubbles of gas due to putrefaction present on surface of the lung. These are :—</p> <ol style="list-style-type: none"> (1) Large and not uniform, (2) Not in groups; (3) Project considerably from the surface of the lung; and (4) The gas in them can be pushed readily from place to place (5) Bubbles collapse on pricking. 	<p>Mottled red or pink and grey with blood vessels over surface.</p> <p>Expanded and reach the sides of the pericardium.</p> <p>Crepitant when handled or cut, and exude frothy blood on section.</p> <p>Inflated air vesicles visible on surface of lung. These are —</p> <ol style="list-style-type: none"> (1) Small, nearly uniform; (2) In Groups; (3) Project only slightly, or not at all; and (4) Cannot be pushed from place to place.

¹ After Guy and Ferrier, p. 116.

(2) **Increase in weight of lungs**, owing to the increased amount of blood they contain.—Hence a test for establishment of respiration has been proposed from the absolute weight of the lungs (Schmidt's test).

As regards this test Guy (from over 400 cases) gives the follow-

untrustworthy. Thus, in nine of Guy's cases, the weight of the lungs of children that had breathed was below 874 grams (the average in still-born children), and in four of the nine below 600 grams. Again, Ogston gives a case where after respiration the lungs weighed only 420 grams. Further, in three of Guy's cases, the weights of the lungs of stillborn children were as follows. 1051, 1480, and 1930 grains, and in two of Ogston's cases, 1180 and 1315 grains.

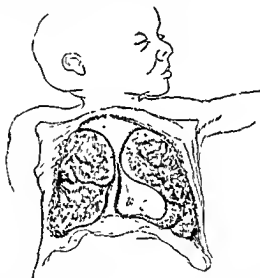


FIG. 27.—Infantile Lungs after breathing for several days.¹

N.B.—Such expansion is only got when child has lived for several days, and seldom then.

(3) **Their specific gravity is lowered**.—In the foetal condition and before distension with air, the lungs are heavier than water. After distension with air they become lighter than water.² Hence if a portion of an undistended lung be thrown into water it sinks, while a portion of a distended lung floats. On this is founded

¹ Guy and Ferrier.

² Taylor found the sp. gr. of undistended lungs to be 1.04, 1.05, and the sp. gr. of the lungs of an infant that had breathed to be 0.91.

The Hydrostatic Test.

Procedure.—The tests should be conducted as follows. The water employed should be of a specific gravity as near 1000 as possible, *e.g.* rain-water, or nearly pure water at 60° Fahrenheit.¹ With this a glass vessel, large enough to allow of the lungs floating, should be nearly filled. The lungs, with the heart attached, having been removed from the body, are to be placed in the vessel, and it is to be noted whether they float or sink. Next, each lung, detached from the heart, is to be separately and similarly tried; then each lung is to be cut into about twelve pieces and each piece also tried. Lastly, it is to be noted whether the pieces, if they float, continue to float after firm but moderate pressure has been applied to them. The pressure should be applied by firmly squeezing each piece separately under water between the finger and thumb. If the gas present be only that due to decomposition it will escape as *large bubbles*, and the piece will subsequently sink. If the air present be due to respiration only, part of this can be expelled and will rise to the surface as a stream of *minute-dots*. The pieces of lung will continue to float unless in advanced decomposition or if undue violence be used in squeezing.

Objections.—It has been objected to the presumption upon which this hydrostatic test is founded that:—

1. Undistended portions of lung may float in water, owing to the presence in the intercellular tissue of air-emphysema, or gases generated by putrefaction. This undoubtedly may occur. But air or gases present

to emphysema or putrefaction. When, however, the lungs are in an

2 Portions of the Distended Lungs may sink in water owing to disease, *eg* congenital tumours, œdema, congestion, hepatization, etc. This is also true. Hence, therefore, if *post mortem* examination shows the existence of very extensive disease of the lungs, we ought logically to refrain from drawing the inference that no portion of either lung has been distended with air, because all portions sink in water. Practically, however, as (1) cases of such very extensive disease of the lungs are extremely rare in newly born infants, and (2) no harm results in criminal cases if the inference drawn is, that the lungs have not been distended, the objection that portions of the distended lungs may sink owing to disease may be disregarded.

Inferences.—Given, then, that the following conditions are complied with —(a) that the lungs are not in an advanced state of putrefaction; (b) that each lung is cut into, say, twelve tolerably equal-sized pieces; and (c) that firm but moderate pressure has been applied to each piece; we may safely conclude that each piece that sinks has not been distended with air, and that each piece that floats has been distended with air.

Hydrostatic Test as Evidence of Respiration.

Conducting the test as directed, and finding that each piece of lung sinks, we come to the conclusion that no portion of either lung has been distended with air, we may practically conclude that respiration has not taken place because: (1) Infants are not known to live for several hours after birth without any portion of their lungs having become distended with air; and (2) in criminal cases, no harm results from drawing the inference that respiration has not taken place. If, however, we find that some or all portions of the lungs have been distended with air, what inference may we then draw as regards respiration? Here it must be pointed out that distension with air may be due either to (a) artificial inflation, or (b) natural respiration, and that it is only when the first of these two causes of distension has been excluded, that we may with safety draw the conclusion, that the distension observed is the result of natural respiration.

Artificial inflation is, however, contra-indicated: (a') if every portion of either lung is distended, because it is extremely difficult even by skilled manipulation to effect complete distension of both lungs *in situ*; so difficult, in fact, that Ogston and others entirely deny the possibility of effecting it; (b') if the lungs on section exude much frothy blood; and (c') if the stomach and intestines are free from air, for it is impossible
 . large proportion of air
 the case also may be.
 exclude artificial infla-

Hence, then, if attending to the precautions specified, we come to the conclusion (every piece floating), that every portion of the lungs has been distended with air, we practically, in cases of infanticide, may safely infer that respiration has taken

place. If, however, we come to the conclusion (some pieces floating and others sinking), that portions of the lungs only have been distended with air; the inference is, that either artificial inflation has been effected, or natural respiration has taken place. The question to which of these causes the distension is due, cannot be decided by the hydrostatic test alone, and in many cases also cannot be decided without taking into account the circumstances of the case. The existence in the otherwise distended lungs of portions in an undistended condition, has been noticed in children in whom natural respiration has been established, and has been described under the name of *atelectasis pulmonum*.

Other evidences of respiration.—If the changes in the lungs indicate that respiration has taken place, no confirmatory evidence is needed, but such may be afforded by the condition of the anterior chest wall, and condition of the diaphragm. After respiration has been established, the former becomes more arched, and the upper surface of the latter becomes less convex

respiration¹

Respiration as Evidence of Live Birth.

It must be pointed out that the two questions, Did this child breathe? and did this child live after its birth? are not strictly concurrent, and that a negative or affirmative answer to the first, does not necessarily involve a similar answer to the second, because—

(a) A child may live after its birth without respiring, or may respire so imperfectly that it may be impossible by *post mortem* examination to obtain satisfactory proof that respiration has taken place.

(b) A child may respire before any part of it has been born.—That this is possible is shown by the fact that cases of vagitus uterinus and ion before birth is, however presentation, or under corded cases of vagitus id (3) not likely to be therefore, to cause full

These two cases excepted, it is obvious that in a criminal case in India, proof that respiration has taken place *de facto*, amounts to proof of live birth, and *vice versa*.

In criminal cases in England a third possibility must be excepted, viz.:

(c) A child may respire after partial and before complete birth.—The

¹ The position of the diaphragm should be ascertained from below before the thorax is opened.

possibility of the occurrence of this is beyond doubt. Whether, however, this has or has not occurred, cannot possibly be decided by *post mortem* examination

Does this child show signs of live birth, other than those directly due to the establishment of respiration?

The most important signs of live birth coming under this description are—

(a) **Presence of food, e.g. milk, or of drugs in the stomach.**—This affords conclusive evidence of live birth.

(b) **Complete absence of meconium from the intestines.**—In exceptional cases, the meconium is completely expelled before birth. but, as a rule, its complete expulsion is not effected until some hours after birth. Hence complete absence of the meconium from the intestines affords strong but not conclusive evidence of live birth.

(c) **Exfoliation of the scarf-skin**—This generally commences about the first day after birth, but sometimes not till later, and may not be complete for a month or more. It is difficult, however, sometimes to distinguish this vital change from peeling of the cuticle resulting from intra-uterine maceration

(d) **Changes in and about the umbilical cord**—These are: (1) Obliterated by concentric of a ring of accompanied by this ring of round the insertion of the cord, often present at birth. (2) Falling off of the umbilicus, day. Shrinking and change, is not a sign of live birth.

(e) **Closure of the special channels of foetal circulation.**—(1) The internal pc internal pc venous cus (nce al tracted for the greater portion of their length, and by the end of the third day the contraction has nearly reached their termination in the iliacs. The vein and ductus venosus contract more slowly, showing

canes, closure before birth has been recorded in the case of the foramen ovale; ductus is on re

the second year. Sometimes the foramen ovale, or the ductus arteriosus, remains patent throughout life.

(f) Other signs of live birth which have been advanced are — (1) Emptiness of the urinary bladder, this is wholly unreliable, and (2) presence of air in the cavity of the tympanum, replacing the gelatinous matter with which this cavity before birth is filled. This indicates that respiration has taken place. As, however, the replacement may not occur for five weeks (Tidy), absence of air from the cavity of the tympanum is wholly unreliable as a sign of still-birth, or of death soon after birth.

ns of live birth may be utilized
how long a child has survived

PROPORTION OF CASES IN WHICH THE FORAMEN OVALE AND DUCTUS ARTERIOSUS HAVE BEEN FOUND OPEN AT VARIOUS PERIODS AFTER BIRTH.

The third column shows (calculated from Tardieu as quoted by Tidy) the proportion of cases in which separation of the cord was found to have taken place (Guy)

Day	Foramen ovale open in cases, per cent.	Ductus arteriosus open in cases, per cent.	Cords separated in cases, per cent.
1	74	68	—
2	68	59	3
3	64	68	17
4	63	63	40
5	45	52	70
6	—	—	90
7	—	—	95
8	25	15	97

CHANGES WHICH OCCUR DURING THE FIRST FEW DAYS AFTER BIRTH.
(Tidy modified)

Period after birth	Conditions observed.
A few minutes to some hours	The stomach contains a frothy fluid, and clots will be found in the vessels of the umbilical cord.
After 24 hours	Concentric thickening of the umbilical arteries near umbilicus.
After 2nd day	Contraction throughout the greater part of the umbilical arteries. Epidermis beginning to exfoliate.
After 3rd day	Umbilical arteries contracted throughout. Slight contraction of the umbilical veins. Formation of inflamed ring round cord.
After 4th day	Cord separated.
After 5th day	Contraction of umbilical veins complete.
8th to 10th day	Fatal circulatory openings obliterated.

Does this child show signs of having been born dead?
The body may show signs of intra-uterine maceration.

This is readily distinguished from ordinary putrefaction. In intra-uterine maceration (1) the odour exhaled by the body differs markedly from the odour of ordinary putrefaction. (2) The skin is coppery red, or

that when death has occurred shortly before delivery, signs indicating intra-uterine maceration will be absent; and (b) that after delivery, ordinary putrefaction may supervene and mask the appearances resulting from intra-uterine maceration. Hence, therefore, while the presence of distinct signs of intra-uterine maceration amounts to positive proof of still birth, no inference can be drawn from the absence of such signs.

What was the Cause of the Child's Death?

Was the child's death due to (a) natural causes, (b) violence, or (c) neglect or omission.

(a) Death of Infant from Natural Causes.

Children are frequently born dead from natural causes. Still-birth is more frequent (a) in first than in subsequent pregnancies, (b) in male than in female children, and (c) among illegitimate than among legitimate children.

Death from natural causes may be due to:

1. **Immaturity and consequent debility.**—When a child is born alive, and dies after its birth, solely in consequence of debility arising from its want of maturity, the question arises, Was the premature delivery, as a result of which the child was born immature, criminally induced or not? If criminally induced, an offence has obviously been committed. By the law of India, however, this offence is not punishable as culpable homicide.¹

On the other hand, according to the law of England, provided, of course, the child lived after its complete birth, the offence which has been committed is murder.²

2. **Debility not due to immaturity.**—A mature infant free from disease, may die from debility, and consequent inability

¹ See *Penal Code*, s. 315.

² See case of *R. v. West*, *Taylor, Med. Jur.*, II. p. 318.

to continue breathing. In such a case the lungs will most probably be found, at any rate in parts, imperfectly distended and portions may be found in a condition of atelectasis (see p 327).

3. Disease.—This may be **general disease**, *e.g.* small-pox, syphilis, or cancer: or **local disease**. If the latter, the seat of the disease may be the lungs, brain, or heart.

1. Congenital disease of lungs.—This, according to Guy, may be (a) hepatization—red or grey—from pneumonia before birth, or “white” or syphilitic, which is common; (b) pulmonary apoplexy, (c) tubercle; (d) oedema, or (e) Devergie’s oedema lardaciforme.

2. Disease of brain and cord may be (a) morbid softening, “but it must be borne in mind that the brain of the fetus is naturally soft and vascular”,¹ (b) effusion of blood (apoplexy) into the substance, cavities, or on to the surface of the brain, or (d) effusion of other fluids, *e.g.* serum or pus.

3. Disease of the heart or large vessels is rare in infancy. Tidy also mentions uric acid infarction, & c. blocking of the kidney tubes with uric acid or urates, as a cause of infant mortality.

Obviously *post mortem* evidence of the existence of disease does not necessarily prove death therefrom; much must depend on the extent of the diseased condition.

4. Malformation.—Death may be due to a congenital malformation, *e.g.* of heart or large vessels; or of the alimentary canal, such as an imperforate gullet or anus; or of diaphragm causing hernia (Powell reports three such cases). No amount of malformation or monstrosity justifies the destruction of the infant.

5. Haemorrhage from apertures of the body may cause death, *e.g.* from the genitals of a female infant, or from the rectum. Two such cases are recorded by Casper.

6. Protracted or complex labour frequently results in the death of the infant. The immediate cause of death may be—

1. Accidental violence to the body of the child (see p 332).

2. Exhaustion from protracted labour.—Death from this cause is frequently accompanied by marks of violence on the body of the child, especially on the head, but may not be so accompanied. Protracted labour is more common in first than in subsequent deliveries; and the greater the disproportion between the size of the child and that of the mother’s pelvis, the more likely is labour to be protracted. Male children are generally larger than female children: hence more male than female children die during delivery.

3. Foetal asphyxia.—Asphyxia may occur before birth, owing to premature separation of the placenta, or be due to (a) the death of the mother, or (b) obstruction to the flow of blood through the cord. With reference to (a), Tidy remarks that there is more chance of saving the

¹ Guy, *For. Med.*, p. 114.

child when the mother has died suddenly, than when her death has occurred slowly. Garetsky concludes that in most cases infants are more or less asphyxiated after the first minute, but that they may be extracted alive in a more or less asphyxiated condition, up to twenty-six minutes after the death of the mother. Harris considers that a child may live still longer (one to two hours). From Tidy's summary of 379 cases of *post mortem* Cæsarean section, it appears that in 81·3 per cent. of the cases the children were dead when extracted, and in 9 per cent. distinctly alive, but of these only one-seventh lived for any length of time. As regards (b), the obstruction to the flow of blood may be due to pressure on the cord from abnormal presentation, *e.g.* foot or breech, or from prolapse

(b) Death from Violence.

Death from violence may be the result of accident, or the violence may have been inflicted intentionally; if the latter, under Indian law, it will be a material question whether or no death resulted from an act done before the birth of the child. Again, death from violence may be due to mechanical violence, or to poison, in the former case, the mode of death may be asphyxia, from suffocation, drowning, or strangulation; or coma, from head injury, or syncope.

1. **Asphyxia from suffocation.**—Accidental suffocation may occur in many ways, *e.g.* from the head being born enveloped in the membranes; from pressure of the child's face against soft bedding; from the child being overlaid by some one in the same bed; or from accidental entry of particles of food into the air-passages. Intentional suffocation is a frequent mode of infanticide. The following are the more commonly adopted methods —

(1) Drawing the membranes tightly over the child's head; (2) closure of the mouth and nostrils by the hand or a cloth; (3) stuffing mud or rags

2. **Asphyxia from drowning.**—Accidental drowning (or suffocation) may occur from the infant falling into a privy or cesspool, owing to the mother being suddenly delivered while in the act of defecation; this may occur even in primipare. Finding the cord torn across,¹ not cut, supports the supposition

¹ Usually about two inches from the navel (Guy).

of the occurrence of such an accident. Accidental drowning may also occur from the infant at the time of delivery falling face downwards into the mother's discharges. Intentional drowning is sometimes resorted to. In some parts of India, immersion of the child's face in milk is a common method of infanticide.

3. Asphyxia from strangulation.—Accidental strangulation may occur from the funis becoming tightly coiled round the neck of the child. Intentional strangulation, by the fingers, funis, or other ligature, is a frequent form of infanticide. As before mentioned (see 'Hanging and Strangulation'), if the ligature employed is a soft one, *e.g.* the funis, no marks may be left on the neck. Casper points out that natural folds on the skin of the neck, especially of fat infants, somewhat resemble marks caused by a ligature. Close examination and dissection of such marks, however, will show no extravasation and no condensation of tissue. If the *post mortem* appearances show that death has been due to asphyxia, much will depend on the absence or presence of marks indicating that the asphyxia has been due to violence. If all such marks are absent, death may have been the result either of accident or intention; it is not possible from the *post mortem* examination to say which. If such marks are present, much will depend on what they are. Some, of themselves, strongly indicate intention, *e.g.* finger-marks on the throat, or rags, etc., firmly impacted in the fauces. Others are consistent with either accident or intention, the probabilities being more in favour of intention than accident, if the amount of violence has been great. A torn cord supports the supposition of accident.

4 Coma.—Death from coma, due to head injury, may occur before labour, during labour, or after delivery. Here it is highly important to note that the '*Caput succedaneum*' is generally a bruise, and after death presents in most cases the appearances of a bruise. On this point Professor Powell notes, "I am afraid that many a false charge of infanticide has been brought through practitioners not recognizing this fact, chiefly owing to the false teaching of text-books that the Caput is a 'serous effusion.'"

Case below). Great violence may, however, be applied to the body of the mother without injury to the fœtus.

2 **During labour.**—Pressure on the head from expulsive efforts during delivery may cause death from coma, either without or with fracture of the skull. The first, and much the most common case (without fracture), is the most frequent cause of death during delivery. In such cases, inside the cranium will be found congestion of the brain and its membranes, and in rare cases extravasation of blood. Outside the cranium a serosanguinolent tumour (*caput succedaneum* or *cephalhematoma*) fre-

Case—Fracture of an infant's skull from attempts to aid delivery.—Dr. Hicks was called by a midwife to aid the delivery of a woman. On examination he observed that the skull was fractured through the parietal bone one side, and there was a slight fracture of the edge of the occipital bone, with a scalp tumour. The head of the child was at the brim of the pelvis, and the fractures had been produced by the midwife in her attempts to push the head back into the cavity.—Taylor, *Med. Jur.*, II. p. 404

3 **After delivery.**—If a woman is delivered in an erect position, and

temporal bones in twenty-two out of the twenty-four cases. As before noted, sudden delivery, leading possibly to such an accident, may occur even in primipara (see following *Case*).

Finding the cord torn across supports the supposition that such an accident has occurred. The average length of the cord is eighteen to twenty inches, it, however, has been found as short as four to six, and as long as fifty four inches. Intentional violence to the head is a common mode of infanticide. In homicidal cases the amount of

with accident. Extensive injury to the head is strongly in favour of homicide, especially if accompanied by a cut cord, and unaccompanied by severe injury to the mother.

5. Syncope or shock.—This may occur from (1) Hæmorrhage from the divided cord, (2) External wounds, (3) Fractures or other internal injuries.

(1) **Hæmorrhage** from the divided cord is more likely to occur (a) when it has been cut across with a sharp instrument, than when it has been divided with a blunt one or torn asunder, (b) when it has been divided close to the umbilicus; (c) when it has been divided almost immediately after birth; and (d) when it is thick and gelatinous. Fatal hæmorrhage from the cord may possibly but not necessarily occur:—(a) If the cord has not been tied, and may occur even if the cord has been torn and not cut. Spontaneous rupture of the cord may occur during delivery, the usual mode of death from this accident is, however, asphyxia, not syncope. (b) From the ligature not being tied sufficiently tight, or from its slipping, or (c) From the navel after separation of the cord.

(2) **External wounds.**—Death from syncope or shock, the result of external wounds, is usually homicidal. Fatal external wounds may, however, be the result of accident, *e.g.* from broken utensils, or the result of an obstetric operation. The nature of the injury may show whether

sharp instrument down the throat or up the rectum. Cases have occurred of the employment of each of these methods. Such injuries obviously strongly indicate homicide; but Ogston,¹ it should be mentioned, records a case of death from accidental thrusting of a small pin through the anterior fontanelle.

(3) **Fractures or other internal injuries.**—Just as fracture of the skull may occur before, during, or after delivery, so fractures of other bones, or dislocations of joints, may similarly occur. Cases even are recorded of women, who have met with no accident during pregnancy, being, after an easy labour, delivered of an infant with more than one of its long bones fractured or dislocated. Fractures or dislocations are not likely to prove immediately fatal, unless the neck be the seat of the

¹ Lect. on Med. Jur., p. 263

injury. Twisting the neck is a frequently employed method of infanticide. Very great force is required to effect this, and hence death from this cause strongly indicates homicide. In one case a woman in her unaided efforts to effect her own delivery, the case being one of breech presentation, employed so great an amount of force, apparently without homicidal intent, as to tear the body of a child completely away from its head.¹

6 Infanticide by poison.—In India poisoning by opium is said to be a commonly employed method of infanticide; and it is alleged that in some cases a peculiar mode of administration is adopted, viz., smearing the mother's nipples with the drug. Opium is largely used (in India as crude opium, and in Europe in the form of syrups containing opium) by women of the lower classes and by nurses (*ayahs*) to keep young children quiet. Hence accidental cases of the poisoning of young children by opium are of common occurrence. Other poisons said to be used in India for the purposes of infanticide are arsenic, tobacco and '*madār*' (*Calotropis sp.*), see '*Poisons.*'

Taylor mentions cases of intentional poisoning of young children by arsenic, sulphuric acid, and phosphorus scraped from the heads of lucifer matches. Accidental poisoning of young children by arsenic has been known to occur, as, for example, in a recent case in England,² where a number were poisoned by the external application of arsenious oxide, introduced as an adulterant into '*violet powder.*' It must not be forgotten that in new-born infants, *post mortem* appearances simulating those of irritant poisoning are sometimes met with as the result of disease, e.g. injection of the mucous membrane of the œsophagus, and ulceration of that of the stomach and intestines. Such appearances have been met with in the bodies of plump and fat children.³

(c) Death from Neglect or Omission.

Omission or neglect may be culpable.—Section 32 of the Indian Penal Code states: "In every part of this code, except where a contrary intention appears from the context, words which refer to acts done extend also to illegal omissions." Death from neglect or omission may be accidental or intentional, and causing death by an intentional and illegal omission may or may not amount to murder. The principal forms of neglect or omission likely to cause death are—

1. Omission to provide assistance during labour.—This may result in the death of the infant from suffocation, head injury from a fall, hæmorrhage from a ruptured cord, etc., etc. (see '*Death from Violence.*'). Two questions which may arise

¹ *Beng. Med. Leg. Rep.*, 1870-7, p. 314.

² See '*Arsenic.*' Chap. XXIV.

³ *Ogston's Lect., Med. Jur.*, p. 272.

in such cases are (1) Is it possible for a pregnant woman to remain ignorant of her state up to the time of her delivery? That this, in exceptional cases, is possible, has already been pointed out (see 'Pregnancy,' p 266), and (2) Would a newly delivered woman be capable of the exertion necessary to save the life of her child? As regards this second question, it may be remarked (a) that in rare cases women have been delivered during profound natural sleep (see *Case* below), and (b), that in some cases women have been known to go through a considerable amount of exertion immediately after delivery (see following case). As a rule, however, a newly delivered woman is capable of but little exertion.

Case.—Unconscious delivery during sleep in a primipara.—Dr. W. Case, of Chicago, attended a primipara whose delivery took place during profound sleep. During the day on which delivery took place she had been feeling unwell, but attributed this to over-fatigue on the previous day. Delivery took place rapidly, and the woman after it was complete, woke up in a fright, having dreamt that something was the matter with her.—*Chevers, Med. Jur.*, p. 707.

Case.—Extraordinary exertion immediately after delivery.—A woman, aged 40, a servant in a Bengali household, was delivered unassisted in an erect posture, of a mature child in the privy of her employer's house at 11 A.M. on the 6th February, 1893. She was doing her duties up to the time of going to that outhouse, and she lost much blood. The placenta came away in about an hour. She wrapped the child in rags and placed it on a shelf in the privy (according to her statement the child died from its head being knocked against the cement floor). After leaving the privy she went about as usual. At 2 P.M. she walked to Howrah station, about 2 miles. She started by the 10 P.M. train, made train
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He found her rather weak, all the organs healthy, the signs of recent delivery were present. The woman was charged with infanticide and concealment of birth, and was convicted on the latter charge.—Dr. Kedurnath Das, *Ind Med. Gaz.*, May, 1894.

Case.—Exertion after delivery.—A Brahman widow, after walking two

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other circumstances of the case, might support the supposition that the omission to tie was intentional. Previous to examining the cut end of the cord, this, if dry, should be softened

in warm water. A clean smooth edge indicates that the cord has been cut; a ragged edge may be the result of division with a blunt instrument or rupture.

is generally divided by a piece of bamboo, and a fact of the cord being found with jagged edges is therefore no proof of neglect. In order to induce the mother to bring forth the after-birth, it is usual to put some hair into her mouth. This causes her to try and vomit, and the effort brings away the placenta. It is also usual to observe certain religious ceremonies before cutting the cord.

3. **Omission to supply** the infant with food or to protect its body against cold may cause its death.—In the first case, absence of all signs of the presence of food in the alimentary canal may, it is possible, indicate the cause of death. In the second case, there may be no distinctive *post mortem* appearances present. Sometimes this omission takes the form of 'abandonment' of the infant. This is an offence, even if death does not result, for by s. 317 of the Indian Penal Code, "Whoever being the father or mother of a child under the age of twelve years, or having the care of such child, shall expose or leave such child in any place with the intention of wholly abandoning such child, shall be punished with imprisonment of either description for a term which may extend to seven years, or with fine, or with both." For a curious legal point arising under this section, see *Case below, R. v. Bejoo*.

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committed the offence there could be no abetment by the other. Of course, a person who has the custody of a child merely for the purpose of exposing it, cannot be indicted as a person "having the care of such child."—*R. v. Bejoo*, 1st Mad. Sess., 1869, *Mayne's Penal Code*, p. 275.

Lastly, by s. 318 of the Indian Penal Code, it is an offence "by secretly burying or otherwise disposing of the dead body of a child, whether such child die before, or after, or during its birth," to intentionally endeavour to conceal "the birth of such child." Women are frequently convicted under this section when the evidence fails to support a graver charge.

Examination of the Alleged Mother.**SIGNS OF DELIVERY.**

The signs of previous delivery, in cases where the signs of recent delivery are absent, have already been discussed (see p 284). The question may, therefore, now be limited to recent delivery. Does this woman exhibit signs of having been recently delivered of a child? On examination during life of a woman who has recently been delivered of a mature, or nearly mature child, the following signs will usually be found —

1 **A general appearance of indisposition.**—This, however, may be present in women, who have not been recently delivered, as the result of any severe illness. Again, this sign may be absent in women who have been recently delivered. Some women, especially those accustomed to labour, appear to be constitutionally but little affected by delivery, and are capable immediately afterwards of resuming their work or undergoing severe exertion. Chevers,¹ on the authority of Ward, states that poor women in the northern parts of Bengal are known to attend to the business of their families the day after delivery; and that sometimes a mother is delivered while at work in a field, carries home the child, and returns there to work the next day. For an instance of very considerable exertion directly after delivery, see *Case*, p. 337.

2. **Organs of generation swollen, contused, or even lacerated.**—A laceration of the fourchette is usually found after delivery in primiparæ. The os uteri may also be found lacerated, and is dilated and soft. The uterus is enlarged; and Ogston² remarks, may for the first two or three days be found to undergo alternate contraction and relaxation under pressure of the hand applied to the abdomen. The abdominal parietes are relaxed, the lineæ albicantes apparent, and a dark line is seen extending from the pubes to the navel.

3. **Breasts**, as in advanced pregnancy, are full and prominent, and the nipples surrounded by well-marked areolæ. Milk will be found exuding from the nipples.

4. **Lochial discharge.**—The presence of this discharge is the most characteristic sign of recent delivery. It is at first coloured with blood, afterwards become brown or green, and has a peculiar odour. The discharge may become almost

¹ *Med Jur.*, p. 774.

² *Lect. Med. Jur.*, p. 155.

wholly suppressed about the third or fourth day under the influence of the milk fever, returning when this has subsided. It usually lasts a week to a fortnight, but may continue longer. Ogston¹ states that in some instances the lochia have been known not to appear at all.

Many of these signs may be present as the result, not of delivery, but of uterine or ovarian disease. No conclusion can, therefore, be safely drawn, unless all, or nearly all, the signs of recent delivery be present. As a rule, the signs of recent delivery cease to be distinguishable after the eighth to the tenth day, and the stronger the woman, and the less severe the labour, the more likely are they to disappear rapidly. The earlier the period of gestation also, at which delivery has taken place, the less marked will be these signs and the more quickly will they disappear. For further signs of recent delivery ascertainable on *post mortem* examination, see 'Causing Miscarriage,' p. 316.

¹ *Lect Med. Jur.*, p. 158.

CHAPTER XVII.

UNNATURAL SEXUAL OFFENCES.

THE desire for unnatural sexual intercourse, so repugnant to the normal mind, may be acquired, or it may be due to perverted sexual instincts in which a man may be psychically a woman and *vice versa*. Even in the acquired sodomy which is so prevalent in the East, it is probable that there may often be some slight abnormality of sexual passion present, since many men who have given themselves up to the most unbridled debauchery never develop any tendency to unnatural intercourse. An unnatural offence is defined by s. 377 of the I. P. Code to be "carnal intercourse against the order of nature with any man, woman, or animal," and, like in rape, "penetration is sufficient to constitute the carnal intercourse necessary to the offence."

of the I. P. Code, does not appear to have as yet been decided.

Three forms of unnatural sexual intercourse are usually described, namely, (1) Sodomy or sexual intercourse between two human beings usually of the male sex (the converse form, Tribadism or sexual congress between two human beings of the female sex is not publicly known); (2) Pæderastia or that form of sodomy in which the passive agent is a boy, a *catamite*; and (3) Bestiality, or sexual intercourse of mankind with the lower animals.

Sodomy.—This offence is largely practised in many countries, and is extensively practised in India. Indeed, Chevers mentions a case where two men, convicted of this crime on their own confession, defended themselves by putting

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Sodomy.—This offence is largely practised in many countries, and is extensively practised in India. Indeed, Chevers mentions a case where two men, convicted of this crime on their own confession, defended themselves by putting

forward the plea that "it was their occupation."¹ The offence is not uncommon in prisons, and it is a well-known prison rule that where more than one prisoner is confined in one cell, the number should never be less than three.

Sometimes the offence is practised between two men, either taking alternately the part of active and passive agent. In other forms of the offence, the passive agent is a boy, and in others, again, a eunuch. In the course of a trial at Mampur in 1852, it came out that a great number of eunuchs regularly practising the offence exist in India; these go by the name of '*hijrahs*,'² dress as living by dancing and singing at their ranks by castrating boys;³ as whole of the genital organs. (See *above* *inquiries* *on* *the* *subject* *of* *the* *hijras* *in* *India* *in* *the* *year* *1852* *in* *the* *Journal* *of* *the* *Asiatic* *Society* *of* *Bombay* *vol.* *VI.* *p.* *133*.)

In India as in Europe false charges of sodomy are sometimes made with consent. In England, sixteen, the one over fourteen alone is charged. In India the question of age in relation to responsibility for this offence is governed by the general exceptions of the Penal Code (*ss.* 82 and 83). As in the case of rape, the question of alleged capacity or the active agent may form part of the inquiry, or whether feeble minded.

Signs of Sodomy.—1. **Habitual practise of the offence.**—Mole adults who habitually practise sodomy often affect effeminate manners, dress like women, etc.; and, as already pointed out, the passive agents in India are frequently eunuchs.

p. 246.

The presence of a chancre about the anus, or of a gonorrhoeal discharge from the rectum, is, of course, strong evidence that the individual has been the passive agent in the offence, and may be corroborative evidence of his having acted in that capacity.

2. **Recent commission of the offence.**—If it is alleged that the offence has been recently committed without consent, both

¹ *Med. Jur.*, p. 703.

² They are to be distinguished from the similarly mutilated eunuchs, *khawajs*, who guard the harems in palaces and are relatively more respectable in their habits.

³ *Med. Jur.*, p. 707.

⁴ *Ibid.*, p. 457.

parties should be examined for marks of violence indicative of a struggle, as in a case of alleged rape, and whether the act has been done with consent or not, the alleged active agent should be examined in the same way as the accused in a rape case. Examination of the passive agent may show stains of blood, or seminal fluid or characteristic gonorrhœal discharge on his clothes or person in the neighbourhood of the part; or if the individual is a young boy or a person unaccustomed to the offence, there may be found about the anus bruising or excoriations of the mucous membrane, or, perhaps, slight laceration of the sphincter. Obviously, also, the question of the age of the parties must be considered, seeing that this bears on the question of their criminal responsibility.

Bestiality.

The form of this offence in which a human male is the active agent is tolerably frequently met with in India. Cases occur every year in which the offence is alleged to have been committed with a goat, a mare, an ass, a cow, and even a hen. In these cases, matters removed from the vagina of the animal with which the offence has been committed, or adhering to the surrounding hairs, may have to be examined for the presence of spermatozoa. Detached hairs may also be found adherent to the person or clothes of the accused, and may have to be examined as to the identity or otherwise of their appearance, with the hairs of the animal employed as the passive agent.

CHAPTER XVIII.

INSANITY AND THE STATE.

Unsoundness of mind.—The general tendency of all mental disorders being to disturb the balance of social environment, it frequently expresses itself in the form of a crime. To guard against this the law places persons of unsound mind under restraint, and the medical jurist is chiefly concerned with the diagnosis and certifying of the fact of insanity.

An insane person is not held responsible for any crime he may commit, and insanity may be accepted as a reason for divorce or for contesting a will. The plea of insanity is sometimes set up dishonestly by the defence in criminal cases to try to escape from the prescribed punishment which would otherwise be imposed by law as a deterrent to sane persons of criminal tendencies—for the safety and security of society is the true object of all legal punishment. While there is thus a danger in too readily acknowledging the presence of insanity as an excuse for crime, the plea of insanity might perhaps, in the interests of society, be set up oftener, as the most serious criminal, the congenital or instinctive criminal, is morally insane, and the community would be better protected against an insane criminal by his permanent incarceration in an asylum than by his being sentenced to a term of imprisonment, after which he is set at large again.

According to modern psychologists all crime is due to a latent or active neurosis or physical defect or degeneration of the brain (but see p. 21).

Prevalence.—A false impression of relatively low prevalence of insanity in India is derived by comparing the Indian official statistics of insanity with those of Europe. In the latter case the greater number of cases are registered and confined in asylums, whereas in India a relatively small proportion are registered, and these largely the dangerous cases. The lower state of civilization in India is also a factor.

a somewhat lower percentage of insanes. For, as has been well expressed by Professor Powell, "Insanity being chiefly exhibited by inability to live up to the dictates of the society to which the individual belongs, it is natural that the higher the standard of civilization, the greater the number of individuals who fall short of the standard. With a lower standard, the number unable to pass becomes less, and in a savage community there are nominally no lunatics." The census of 1901 revealed a proportion of only two insane persons for every 10,000 of the

family insanity being no less acutely felt in the Orient than in the Occident—the Indian figures are fallacious, in that many idiots, chiefly cretins and deaf mutes, all persons who are weak-minded and all those whose insanity is adjudged by the uneducated enumerator or by the friends to be of a temporary character, are rigidly excluded. All these persons would be returned as insane in England; the statistics of the two countries are, therefore, not comparable. In further proof of this, reference may be made to the special investigation of 327 deaf mutes, none of whom had been returned as also insane at the census; no fewer than 153 of these were found to be mentally defective to a greater or less degree. The number of deaf mutes in India is very great, viz. 153,168, and it is probable that more than half of these are also insane. Besides, there is an enormous class of religious mendicants, sadhus, and fakirs—non-existent in Europe—the majority of whom are certifiably insane, and *many of whom are very dangerous insanes*, although they are permitted, in virtue of the superstitious reverence in which they are held by the masses, to roam about. The relation of these vagabond ascetics to the prevalence of crime and insanity in India is as important as it is interesting.

The majority of Indian insanes are detained and cared for in their own homes. Of the total number enumerated in 1901, viz. 22,941, only about a fourth were lodged in asylums. Nearly 25 per cent. of the asylum population are criminals, while only 20 per cent. are women.

Causes.—The causes of insanity may be broadly classed as physical and moral. It should be remembered, however, that in nearly every case of insanity there is more than one factor, either predisposing to or actually exciting the condition.

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a somewhat lower percentage of insanes. For, as has been well expressed by Professor Powell, "Insanity being chiefly exhibited by inability to live up to the dictates of the society to which the individual belongs, it is natural that the higher the standard of civilization, the greater the number of individuals who fall short of the standard. With a lower standard, the number unable to pass becomes less, and in a savage community there are nominally no lunatics." The census of 1901 revealed a proportion of only two insane persons for every 10,000 of the

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Physical.—In many cases of insanity there is an obvious defect in the nerve centres of the brain to account for that

impairment or derangement of the brain which we call insanity. But in others the defect, if present, is not apparent to the pathologist. The chief physical causes are:—

1 **Congenital defects in constitution.**—This may show itself as arrest of development occurring before or soon after birth, giving rise to amentia (p. 348). In such cases there may or may not be visible head deformity. The arrest of development may be due to changes interfering with the growth of the skull bones, as in cretinism (p. 352). Hereditary insanity may come under this head. At Berhampore, Bengal, among 575 male patients treated during 1907, in 46 a definite history of hereditary or family tendency to insanity was obtained; but it should be observed that the records of most of the patients are imperfect, and it is not possible to trace their antecedents.

2. **Injury or disease.**—Epilepsy, injury to the head, and sunstroke may all give rise to insanity. Bucknill and Tuke estimate that epilepsy is the cause of about 6 per cent. of the admissions for insanity into asylums. In 28 out of 575 male insanes treated at Berhampore in 1907 the insanity was due to epilepsy, cases of congenital defect combined with epilepsy being, of course, excluded. Wasting diseases, *e.g.* tuberculosis, specific fevers, uterine and ovarian disorders may give rise to insanity. Pregnancy is sometimes accompanied by insanity, the patient often recovering after delivery. Insanity has also been traced to the changes of puberty, to the onset of senility, and to the effects of the menopause. Intestinal irritation, a toxic factor probably, has also caused insanity.

3. **Intoxication by the use of drugs, such as Indian hemp and alcohol.**—In 1907, out of 5474 insanes in Indian asylums, in 602 the insanity was ascribed to hemp drugs, in 135 to alcohol, and in only 31 to opium. The smoking of Indian hemp, either as *ganja bhang* or *charas*,¹ is the most common cause of insanity in India. Of 575 male insanes at Berhampore in 1907, 51 were cases definitely due to previous indulgence in *ganja*, and in a number of other cases there was a probability of this factor having had greater or less effect. Popularly speaking, the effect of hemp drugs in the causation of insanity in India has been overrated, while, on the other hand, it was distinctly underestimated by the Hemp Drugs Commission of 1894. As Major G. Ewens has shown,² about

¹ See for *Ganja*, etc., p. 360.

² *Ind. Med. Gaz.*, November, 1904, and *Insanity in India*, 128, etc., 1908.

20 per cent. of the insanity among males can be attributed to the abuse of hemp drugs.

Alcohol, such a common cause and such a potent contributory factor to insanity in Europe, is not so in India, where spirit drinking, as has been stated above, is not common. Opium is an uncommon cause of insanity.

Moral.—Moral causes are grief, domestic trouble, religious anxiety or excitement, and mental overwork. In India, in 1906, out of 2777 insanes in whom the cause was shown, in 776, or nearly 30 per cent., the cause was of a moral character, chiefly grief or religion.

General signs—Delusions.—The disordered mind in insanity may be the subject of delusions or hallucinations, though the absence of either of these in undoubted cases of insanity is not uncommon. A 'delusion' is a perversion of the judgment whereby the individual accepts as real an erroneous perception or conception which has no real existence; hence a delusion, if not removable by the presentation of facts and powers of reason, is evidence of a disordered intellect. The delusions of an insane person concern his own personality. 'Illusion,' on the other hand, is merely a false perception by the senses of an external impulse. It is objective with no disorder of the reasoning faculty, for the affected individual on closer inspection perceives that he has been the subject of a false impression. Illusions are mostly visual, but may affect other senses, such as hearing and smell. A common instance is when in a dimly lit room a person supposes he sees the figure of a man, but on closer inspection finds it is only a suspended coat. The spectacular display of 'Pepper's ghost' is an illusion. Hallucination is differentiated from a delusion, in that it is an erroneous perception without an external impulse. It may affect more than one of the senses. If it be rejected by the reasoning faculties there is no insanity; but if accepted by them, a delusion results. Hallucinations of hearing are the most common in insanity, the person hears voices speaking to him when there is absolute silence. In *delirium tremens* there are hallucinations of sight.

Forms of Insanity.

That group of disorders of the brain which is called 'insanity' comprises such varied conditions with overlapping symptoms that various classifications of an arbitrary kind have

been proposed. In the present state of our knowledge any classification of insanity must necessarily be, as Savage has recently remarked, provisional. For medico-legal purposes, however, we may classify the various types of insanity as follows:—

- I. *Amentia*, or '*Dementia naturalis*,' congenital insanity due to the arrest of development of the nerve-centres.
- II. *Dementia proper*, or '*Dementia adventitia vel accidentalis*,' degenerative acquired imbecility, due to degeneration or failure of the nerve-centres.
- III. *Acquired active insanity* from disorder of nerve-centres.

The chief forms within these groups may be roughly tabulated thus:—

Classification of Forms of Insanity.

I. AMENTIA (congenital)	{ Complete, or Idiocy, including Cretinism. Partial, or Imbecility.
II DEMENTIA (acquired)	{ Primary from masturbation, etc. (D. præcox). Secondary, apoplectic and epileptic, syphilis, sunstroke, ¹ etc. Senile Paralytic, general paralysis of insane (G.P.I.).
III ACTIVE ACQUIRED INSANITY	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>Delirium of fever, puerperal, alco- hol, hemp, etc., usually tempo-</p> </div> <div style="margin-right: 10px;"> <p>Stupor.</p> </div> <div> <p>MORAL { General (unbridled depravity). Partial { Kleptomania, } Impulsive Incendiary. } insanity. Pyromania. Dipsomania</p> </div> </div>

I. Amentia.

In this form of insanity the individual is of unsound mind from birth. Hence amentia corresponds to what legal writers call '*dementia naturalis*,' or '*the fool natural*.' Two forms of amentia are recognized by medical writers, namely, (1) Complete amentia, or idiocy; and (2) Partial amentia, or imbecility; and '*Cretinism*' may be added as a third form.

¹ See acute primary dementia, p. 353.

(1) **Complete amentia, or idiocy.**—In this form of amentia the arrest of development not only affects the higher or intellectual nerve-centres, but appears also to affect the centres of sensorial perception. Hence, in the fully developed form of complete amentia, the individual carries on a mere vegetable existence, not having the sense even to eat or drink. In the more common and less developed form there is a certain amount of intelligence; the individual recognizes his friends, is capable with extreme difficulty of acquiring a certain amount of education and is able to make his wants known by signs, or imperfectly articulated words. In almost all there is visible bodily deformity, the cranium is small, its vertex depressed, and the forehead retreating. The palate is narrow and unduly arched, the face seems to occupy the whole of the front part of the head, the expression is vacant, there is often squint, hare-lip, or other sign of non-development; many are deaf-mutes. Their habits are often disgusting, their sense of taste or smell being frequently defective, they eat or drink anything, filthy or not. Some pass their evacuations unconsciously.

(2) **Partial amentia, or imbecility.**—It is difficult to draw any precise line of demarcation between partial and complete amentia. In imbecility, however, there is not that marked want of development of the centres of sensorial perception which is present in
of the faculty of sp
cility from idiocy

namely, (1) Intellectual imbecility, and (2) Moral imbecility.

Of the two, intellectual imbecility is the form which most closely approaches to idiocy in its characters, the affected individuals in well-marked cases only differing from those suffering from complete amentia in its less pronounced forms, in possessing the power of speech. Intellectual imbeciles, although markedly deficient in general intellectual power, are capable of acquiring an amount of education sufficient to fit them for carrying on duties requiring no great mental effort (see *Cases (c) and (e)* below). In moral imbecility the defective development appears to affect chiefly the higher functions of the brain, the affected individual, although fairly intelligent and shrewd, being seemingly deficient in moral sense and in power of self-control (see *Cases (f) and (g)* below), his mental condition in some cases closely approaching to that present in moral mania. It may further be noted that in some cases of imbecility the individuals are greatly "under the dominion of childish fancies" approaching in character to delusions (see *Case (g)* below).

Imbeciles may commit such serious crimes as murder. In Eastern climes, where there are generally vagabonds liable to be abused and teased beyond endurance on account of their haviour, they not infrequently commit such crimes. Of twenty-one imbeciles who had been charged with various crimes, chiefly thefts, five had committed murders and two grievous assaults (see *Cases (a)* and *(b)* below).

Case (a).—Imbecility (high grade) with homicidal propensity.—B. B., a Hindu male, admitted to Berhampur Asylum in August, 1895. A congenital imbecile whose father was insane and whose brother committed suicide. A native of Birbhum. One day he went with his wife and child to cut wood and while employed thus he suddenly murdered them both without apparent motive or cause. A foolish-looking high-grade imbecile, fairly intellectual and capable of simple work. Can talk, but rarely does so. Memory very defective.—C. J. R. Milne, 1908.

Case (b).—Imbecility (low grade—without epilepsy).—Kali Lodha, admitted in 1904, at the age of 18 charged with theft. Some years previously had been convicted of theft and was then disowned by his relatives and became a vagabond thief. A smiling happy imbecile, with a fair amount of general intelligence. Childish in manner and behaviour. Speech limited to a few words. Harmless. Has shown no signs of improvement because he has been well cared for and has been satisfied.—C. J. R. Milne, 1908.

Case (c).—Intellectual imbecility.—"A man of forty, of weak intellect from birth, but capable of such education as fitted him to be a copying clerk. He fell into bad company, committed theft, and was tried and acquitted on the ground of insanity. In general he is quiet, inoffensive, and taciturn, but answers simple questions rationally. He is subject to frequent attacks of excitement, preceded by shuffling of the feet. In these attacks, which last several days, he talks incoherently, is restless and will strike and kick those about him. When he was about thirty years old he shut the door of his room, placed a long form close to the fire, laid himself on the form, and his head on the grate. He was found insensible, but, on being removed to an open window, had copious bleeding from the nose, and soon came to his senses. His head was burnt to the bone."—Guy, *For. Med.*, p. 164.

and while going to spend part of the money with the first person he met, dropped first one and then another note at his feet. When questioned, he could see no difference between killing a man and killing an ox, except that he "would never hear him fiddle again," and he looked on the watch as an animal, and when it stopped, thought it had died of cold from the glass being broken. In his parish he was known as "daff Jock Barclay," and the clergyman, who knew him well, "always regarded him as imbecile, and had never been able to give him any religious instruction, and did not consider him a responsible being."—Guy's *Factors of the Unsound Mind*, p. 173.

Case (e) — Moral Imbecility.—Cuthbert Carr gave himself up to the

attacked with venereal disease, and his object of having connection with the child was to cure himself. After the murder he showed great shrewd-

tune, etc., etc. Dr. Browne reported that he found him to be labouring under mental weakness or defect, probably congenital, and that his general appearance and manners were such as are usually associated with partial mental defect or eccentricity. That otherwise he was of fully average intelligence, expressing himself with accuracy and facility, that his powers of calculation and memory were unusually acute, and that he was perfectly capable of distinguishing between right and wrong. He was acquitted on the ground of insanity—*Browne's Med. Jur. of Insanity*, p. 71.

Case (f) — The Windham Case.—In this case W. F. Windham was alleged to be of unsound mind and incapable of managing his affairs. It was proved that he had been sent to Eton, but that he had profited very little by the means of education which were placed in his power. He was wholly unlike other boys, and when he came of age, in 1861, his conduct was such as to lead to a belief in the minds of those who were acquainted with his position, that he was insane. It was further proved that he was utterly deficient in business capacity; that he was extravagant in purchasing articles which he did not require at exorbitant prices and in unnecessary quantities; that in consequence of such acts he incurred enormous debts, without having any reasonable prospect of being able to meet the demands when they became due; that he was guilty of gross indecency of language and conduct in public places, and that even the presence of ladies was not a restraint; that his appetite was voracious, that he associated constantly with people of the most indifferent character; that three weeks after he came of age he married

value of from £12,000 to £14,000, and settled £800 a year on her for life; that his income, at the time he did this, was not more than £1500 per

of sound mind, and capable of taking care of himself and his affairs.—*Browne, ib.*, p. 67.

away its life, that he might be tried for his act and removed from a place where there were no windmills. He had always been violent when thwarted in his fancy, had threatened his keepers and members of his family, and had more than once made preparations for committing murder"—Guy's *For. Med.*, p 166

To these may be added as a third form:—

(3) **Cretinism.**—This is the name given to a form of endemic idiocy prevalent in certain hill or sub-montane districts, and apparently the result of local conditions. It is met with in the Sub-Himalayas in India, and probably due to goitre in mother and dependent on developmental changes interfering with the growth of the skull bones. It is usually associated with atrophy of the thyroid gland in the individual or with goitre in his parents. The skin is usually coarse and dry.

Cretinism or Infantile Myxoedema is a condition brought about by absence or faulty development of the thyroid gland. It is endemic in association with goitre among adults, in certain hill districts and valleys, such as parts of Switzerland, Tirol, the Himalayas, and the Kassiya and Jaintia Hills. Sporadic cases also occur, generally as a result of atrophy of the thyroid following some specific fever.

Symptoms.—Toward the end of the first year of life it is noticed that the child is mentally dull, makes no effort to crawl, walk or speak, and takes no notice of its surroundings. It is then seen that the child has ceased to grow, that the skin is rough and dry, the hair dry and scanty. Later it is observed that the face is heavy, pasty and bloated, the nose flat, its alæ thick. The eyelids are heavy and puffy, the lips thick and pendulous; the tongue, large and swollen, hangs out of the mouth, allowing saliva to dribble, and gives the child a particularly fatuous expression.

Ossification and dentition are delayed, and the child grows up an imbecile, pot-bellied dwarf with short, thick, and stumpy arms and legs.

Case.—Cretinism.—Hindu woman, aged 18. Height 28 inches. Looks like a pot-bellied baby two years old. Cannot stand without holding

of the same diameter. Her breasts and pubenda are infantile. There is no hair on the pubes or in the axilla. The hairs of the scalp are

very sparse and do not exceed three inches in length though they have never been cut.

She was treated with thyroid extract, rather irregularly and intermittently, with considerable improvement, so that two years later her condition was—

Height 34 inches. She keeps her tongue inside her lips, which have become much thinner and are kept shut. She smiles quite amiably when any one she likes approaches. There is a difference of two inches between the circumference of the calf and the ankle. Her breasts have considerably enlarged. The hair of the scalp and eyebrows has become nearly normal in thickness. She walks but is lazy. Plays with toys, calls for food when hungry. She cries, smiles, gets angry or sulky on appropriate stimuli like children of four or five years of age. Is clean in her habits and is developing a little womanish vanity. She has a vocabulary of about a hundred words.—Professor Powell's Reports, 1917.

II. Dementia.

Legal writers use this term as synonymous with insanity, grouping all cases of mental alienation under the two heads of (1) *Dementia naturalis*, or 'the fool natural,' i.e. individuals insane from birth; and (2) *Dementia adventitia*, or *accidentalis*, i.e. an acquired imbecility—individuals who become insane after birth.¹

In medicine the term *dementia* is employed to denote that form of insanity in which the mental powers, having attained maturity, subsequently fail, the individual falling into a condition more or less resembling amentia, but distinguished from amentia, by being the result of failure of power previously present, and not the result of original want of power. Dementia may be acute, that is, come on suddenly; or chronic, i.e. come on slowly; and may be secondary, i.e. follow on a previous attack of mental or other disease; or primary, i.e. come on unpreceded by any such attack. Occasionally dementia is both acute and primary.² Acute may follow a serious attack of brain or other disease, e.g. typhoid and malarial, or cerebro-spinal fever, etc. Recovery may take place from acute dementia. The form known as *Dementia praecox*, which comes on soon after puberty, and whose exciting cause is often sexual, is not uncommon in India.

Usually dementia is chronic, and secondary to an attack of acute mania or melancholia, or it may supervene as the result of old age (senile dementia). When dementia comes on slowly, often the first symptom noticed is failure of memory. This is followed by general dulness of all the mental faculties. The

¹ Guy, *For. Med.*, p. 166.

² In India acute primary dementia, always rare, is when met with generally a result of sunstroke.

bodily health is usually good. In very advanced cases the functions of the centres of sensorial perception become impaired—indeed, insensibility to pain is often noticed in the early stages—and the animal instincts even are lost. Recovery rarely, if ever, takes place from chronic dementia. Dementia may be accompanied by occasional attacks of maniacal excitement.

*Case—Primary dementia (Dementia praecox).—*B. Ch. R., admitted into the Be Hindu male, insane. Until then became has continued looking man extremely filthy. After admission but only about his food. His appetite poor at first, then became voracious, and he was observed on more than one occasion to eat filth. He was absolutely shameless, masturbating frequently in public. For six years he continued to exist as a filthy dement with no thoughts but for food. In February, 1907, he was admitted into hospital suffering from Bright's disease, and he died of this a year later.—C. J. R. Milne, 1908.

Case.—Secondary
December 21, 1866, to aggressive mania, who present state of dement childish vagabond with a very defective memory and devoid of intelligence. At times irritable if interfered with. Has a voracious appetite and is very indifferent to clothing.—C. J. R. Milne, 1908.

*Case—Senile dementia.—*R Ch K, an old man of 70, a poor cultivator one day, having, ized and ted in a state of physical debility, placed in hospital on admission suffering from heart disease. Died three months after admission.—C. J. R. Milne, 1908

General paralysis of the insane.—This is the name given to a form of dementia, in which the failure of the power of the higher or intellectual nerve-centres is accompanied by failure of power of the motor-centres. G. P. I is more common among men than women. It frequently attacks men of education and position. Like tabes it is due to syphilis, 60 to 70 per cent. giving a positive Wasserman reaction, but, as has been remarked, both general paralysis and tabes are rare amongst uncivilized or half-civilized races notwithstanding the frequency of syphilis.

Of 4200 Indian cases of insanity coming under Powell's observation in the past sixteen years, only three were G.P.I.

medico-legal importance (see 'General Intellectual Mania,' p. 357).

The offences of a G. P. I may be classed under three heads:¹ (1) Violence of a peculiarly brutish and irrational character; (2) Sexual impropriety, doubtless partly from lack of judgment and partly from the sexual irritability common in earlier stages; (3) Theft.

III. Mania or Raving Madness.

ACTIVE ACQUIRED INSANITY.

Under this head may be classed all forms of insanity characterized by disturbance or disorder (as distinguished from want of development, or failure) of the functions of the higher nerve-centres.² Unlike amentia and dementia, mania is seldom continuous, there being usually remissions, more or less complete. If complete, a remission constitutes what is termed a 'lucid interval' (see *Case*, p. 355). Mania may come on suddenly or slowly; if slowly certain **premonitory symptoms** are usually first noticed. The chief of these are indigestion, constipation, and sleeplessness; altered or perverted sensations, sometimes amounting to illusions; great irritability, alterations of temper, disposition, and habits, and inability to concentrate

richer, or stronger than he really is, (2) Misanthropy, or general dislike to others without cause; and (3) Suspicion, often leading to delusions of the existence of conspiracies to injure or poison the sufferer.³

Case.—**A recurrent mania.**—This case exemplifies a type of insanity which is not uncommonly met with in India, and which is perhaps the saddest of all the mental disorders to which human beings are liable.—R. K. G., a high caste Hindu of good family and superior education, formerly a schoolmaster, became insane at the age of 29 through, it is stated, over-study. It is important to note that there was no hereditary tendency to mental disorder, and no marked previous alcoholic or other excess. Admitted in 1895 at the age of 40. Every

¹ Taylor, *Med. Jur.*, II, p. 467.

sleepless, and spends the night singing obscene songs. The attack begins suddenly, but for a day or two prior to it there is a curious alteration in expression which the attendants are well aware of as heralding an attack. He may be dangerously aggressive at the onset, and hence this alteration is carefully observed. Recovery is fairly rapid, and is complete. In the intervals the man is absolutely sane. His memory is good except for the attacks of insanity, of which he remains curiously oblivious.—C. J. R. Milne, 1908.

1 General Intellectual or Ideational Mania.

MELANCHOLIA

In this form of mania there appears to be general disorder of the functions of the higher nerve-centres. It is divisible into a non-melancholic form and a melancholic form, according as to whether excitement or depression is present. Some writers on insanity limit the application of the term 'mania' to the non-melancholic variety of this form of insanity, and apply the term 'general melancholia,' or 'lypemanía,' to the melancholic variety. Sometimes the two forms blend, excitement and depression alternating with one another in the same case.

The principal symptoms of general intellectual mania are:—Rapid flow of ideas, expressed with confusion and incoherence; the attention is constantly wandering, and delusions rapidly succeed one another. In one form the individual fears everybody and everything (panophobia); in another he imagines himself pursued by horrible demons (demonomania), the toxic mania of delirium

or, in the melan

depression. The

the patient is often violent and very destructive, rendering great caution necessary in visiting him. The expression is altered, he sleeps but little, and there is often (especially if the case is tending towards general paralysis) deficient sensibility to pain. The fact that in this form of insanity there is often diminished sensibility to pain, may be of importance in cases where injuries received by insane persons form the subject of an inquiry: (a) from its indirectly tending to increase the amount of injury likely to be inflicted during a struggle; and, (b) as bearing on the question of the time of infliction of an injury.

A special form of general mania has an acute delirium as its chief feature, and is invariably fatal; it is known as 'Acute Delirious Mania.'

Case.—Acute delirious mania.—In this case alcohol was a prominent factor as far as the first attack of mania was concerned. While suffering from this he was brought to the asylum, and beyond evidences of his recent alcoholic bout, there was nothing special about his attack. He then recovered almost completely, but on the fourteenth day, after the cessation of the acute symptoms of the first attack, he again developed acute mania, accompanied, this time, by fever and delirium. To this he succumbed. The following are the details of the case:—

A. P., Goineke, aged about 25, employed in a railway refreshment room, was admitted into the asylum on April 3, 1905. His friends stated that he had always been considered a foolish person, talking nonsense on occasion, and having generally exalted ideas about himself. On the night of March 23, although a usually temperate man, he, assisted by a friend, drank about a bottle and a half of whiskey, and after this he became acutely maniacal. He was very excited, abusive and noisy. He broke a quantity of glass and plate. He became very filthy, and for three days he refused his food. He was brought to Lahore and admitted, as stated, on April 3. He was then in a state of exaltation with delusions of being a great chief, of having served in great houses, of having visited the Pope at Rome. He said he had been sent to the asylum by Christ, etc. He had a vacant look, and was extremely restless and loquacious. He was very filthy with excreta, and tore his clothes and bedding into ribbons. He was noisy at night, and slept very little. Under treatment he daily improved, becoming cleanly in his habits, respectful in his attitude and generally behaving quietly. He appeared to be reaching a normal state when, rather suddenly, on the night of the 21st, he became again acutely maniacal, destroying his clothes, etc., and incoherent, with temperature 101° . On the 23rd still feverish (102°), and had become almost unconscious. On the 24th, temperature rose to 104° , when he was visibly delirious, and he died unconscious on the morning of the 25th. No *post mortem* permitted.—C. J. R. Milne, *Ind. Med. Gaz.*, 1906.

Case.—Melancholia of recent origin.—M. D., a young Hindu, aged 23, admitted from Midnapore on March 20, 1904. Except that his

was declared sane, and has continued in this condition.—C. J. R. Milne, 1908

Case.—Chronic melancholia.—B. A., Mussalman woman. At the age of 32 is said to have had five children at birth, four of which were still-born and one alive, which died shortly afterwards. During these births a urethral fistula was caused, and was left untreated. This caused her to be an object of disgust, and her mind gave way under the combined influences of bodily trouble and grief. In her insane state she

set fire to a godown, and was sent to the asylum, where she has continued in a state of chronic mental depression. She is very irritable, and if thwarted, may be aggressive. She is always in a state of abject misery, and no amount of kindness or comfort has any effect. Treatment of her urethral condition is negatived by her being in an advanced condition of pulmonary tuberculosis.—C. J. R. Milne, 1908

Insanity with epilepsy.—Insanity consequent on epilepsy is not infrequently seen in India. In most of the sufferers the epilepsy is said to have come on after puberty. Some of these epileptics are continuously insane, while others are only insane before or after their seizures. The epileptic seizure, the classical 'grand mal,' may be replaced by an attack of acute mania, generally of short duration, and from a medico-legal point of view this is important. Epileptic insanes are among the most dangerous of all insanes, and those in India form no exception to the rule. The type of insanity met with in epileptics is most commonly mania, but occasionally an epileptic melancholia may be observed. Dementia generally comes on early in epileptic cases, and is usually profound. Epileptics are sorely tried during very hot weather, and are then liable to attacks of status epilepticus, frequently fatal.

Case.—Epileptic mania homicide.—R. R., from Tributary Orissa, began to suffer from epilepsy at the age of 25, in 1900. The first fit was a very severe one, and he fell into a fire, extensively scarring his left chest and arm. On August 7, 1905, he was sentenced to transportation for life for murdering his mother under the following circumstances. He was seen one day to drag his mother, who was bleeding from a wound of the head, from his house; in his other hand he had a bloody axe.

very excited immediately after for a couple of hours, and has then to be kept apart.—C. J. R. Milne, 1908.

Toxic insanity is, most commonly alcoholic, or due to Indian hemp or puerperal sepsis.

1. Alcoholic insanity.—Insanity due to alcohol is now (1917) by no means rare in India.

Case.—Alcoholic insanity.—R. S., an aborigine from Midnapore, admitted in December, 1904, into Dullunda Asylum with the following history: For many years had indulged excessively in native liquor

(pachai—a spirit distilled from rice). On two occasions he had had attacks of acute mania. During the second of these, which followed directly a bout of great intemperance, he came up one evening to another Santal, who was sitting in front of his house, and without saying a word killed him with an axe. He was then arrested and sent to jail, where he was admitted in a state of wild excitement. He was then sent to the asylum. He was sane on admission, and continued to be sane until March, 1905, when he began suddenly to talk nonsense, and then fell into a state of stuporous depression. Some days later he was caught in the act of making preparations for committing suicide. This state of depression was followed by an attack of acute mania which was characterized by noise, aggressiveness, and extremely filthy habits. This gradually subsided after a duration of nearly two months. He then recovered and continued to be sane, and was sent for trial in September, 1905, and returned to the asylum in March, 1906. In May, 1906, another attack of depression, with another suicidal attempt, was again followed by a period of maniacal excitement, shorter in duration, however, than that of the previous year. He recovered completely and continued sane for a year. In August, 1907, he had an attack of simple mania lasting for three weeks. In January and February of the present year, he has had two successive short attacks, and his case is developing into one of recurrent mania.—C. J. R. Milne, 1908.

2. Hemp drugs.—Major G. F. W. Ewens has shown¹ that indulgence in hemp drugs is responsible for a great many of the cases of mania admitted into the Punjab Asylum. Of 543 such cases admitted in the triennium 1900–1903, in 161 their causation could be reasonably assigned to the hemp habit. This proportion is very high, and is higher than in the Lower Provinces. In Berhampore, of 332 cases of mania, in only 56 can indulgence in hemp be attributed as the cause. The reason of this, however, in all probability lies in the fact that whereas in the Punjab the more potent resin—charas—is the preparation used, in Bengal it is ganja, a much milder drug. With an experience of both provinces, I can further state that the toxic mania due to charas indulgence is much greater in degree to that seen after indulgence in ganja. Both are, however, exactly similar in type. The Hemp Drugs Commission came to the conclusion that hemp drug indulgence had been grossly exaggerated as a factor in the production of insanity, and that in very few cases could it be definitely shown that previous hemp smoking had caused the mental alienation. That their conclusions were incorrect Ewens has definitely proved as regards the causation of mania.

Hemp drug indulgence, either as ganja or as charas, is common in many parts of India. It is chiefly in vogue among religious mendicants—the vagabond pests of India—and among the lower castes resident in the larger towns and villages.

¹ *Ind. Med. Gaz.*, November, 1904; and *Insanity in India*, pp. 128, etc., 1908.

Were it not for fakirs and sadhus, who extol its virtues, the practice would soon die out. Comparatively few persons, then, indulge in these drugs, were larger numbers to do so our asylum populations would become proportionately increased.

The drug is partaken of in one of three principal forms: bhang, ganja, or charas. Bhang is a decoction of the leaves, and is very mild as a rule, but it may be the reverse, and is then frequently adulterated with dhatura and other drugs. Ganja are the dried flowering tops of the female plants matted together by resin. It is smoked along with tobacco, as is charas, which is the crude resin extracted from the flowering heads by rubbing these in the hands and scraping off the resin left adherent to the palms. It is also contained in the sweetmeat Majun (see p. 642).

A single indulgence in any of these forms may produce a prolonged intoxication or a mania transitoria. Continued and excessive indulgence leads sooner or later, in many of those who

elate.
Filth.
tendency to aggressiveness are constant features. Physical signs are absent except a peculiar conjunctival congestion. This state of mania may last for a varying period. It may then be completely recovered from, or the subject may fall into a state of mild chronic mania with weakmindedness, which is chiefly remarkable for its defects in memory of time and place. The period of mania in ganja cases is nearly always a period of oblivion. Old hemp cases in asylums are remarkable for their false ideas of time. Their ages, as told by them, are absurdly greater or less than the actuals. Recurrences are common if the habit is resumed. The craving for the drug soon passes off and the abrupt manner in which the indulgence can be stopped is remarkable. A few cases terminate in complete dementia, but a very partial dementia is the commonest issue of hemp manias.

Case—Mania transitoria following bhang drinking.—S. R., a Hindu boy of 17, was admitted into the asylum on April 1, 1905, with the following history: He had been employed at Ajmere by a Babu in some domestic capacity. Some difference of opinion had arisen between him and one of the other servants: the patient, being the younger, agreed to make up the quarrel and was induced to drink a tumblerful of bhang by the other, as if to celebrate the settling of their differences. This occurred on the evening of March 25, 1905, and on the following evening,

On admission he was and destructive. On emphasizing each syllable His face was flushed and his coat clothes and preferred to remain filthy After about five days he his normal healthy condition. He gave a coherent account, which was afterwards fully verified, remained in the asylum to the institution as a boy discharged to the care of his friends.—C. J. R. Milne, 1906.

Case—Mania transitoria following charas smoking.—N. G., a Hindu, aged 30, a criminal lunatic, was admitted into the asylum on November 28, 1900, being confined under s. 471 Criminal Procedure Code. On February 21, 1900, this man killed an old woman by beating her on the head with a stick, and remained sitting by the body after the deed. No apparent motive for the murder could be ascertained. Evidence was given to show that the patient's father had been insane, and the patient had on previous occasions exhibited signs of insanity. He was therefore acquitted on the ground of insanity, and confined in the asylum under the section quoted. No history of indulgence in drugs was forthcoming at the trial. When admitted he seemed dull and stupid, and his memory was apparently defective. Otherwise he appeared to be quite sane. Eventually it is recorded in his case that the man is "an unprincipled scheming liar." He was reckoned as 'sane' until July, 1905. On the 14th of that month he was found in his cubicle smoking *charas*, being then in a dazed condition: a quantity of *charas* was also found in his room. He had, as was discovered, obtained this *charas* from the private servant of another patient, a sirdar of good family. Following this bout of *charas* smoking he became acutely maniacal, being violent, noisy and destructive. He remained thus for nearly three weeks and then gradually recovered. He is quite sane at present, works well, but is an expert in the art of mendacity.—C. J. R. Milne, 1906.

Case—A third recurrence of the drug habit followed by imperfect recovery.—In Major Ewens' series this is No. 66, and the case is also are habit again On

his excreta. With varying acuteness this state lasted for about four weeks, when he began to recover, allowing the stump of his finger to be dressed, and becoming generally cleaner in his habits. In June he had

without discoverable cause, another attack of acute mania lasting about four days. Improvement followed this, but it has never been perfect, and his previous condition has not yet, ten months after his attack, been attained. Although he can talk sensibly to a certain degree, he is in a state of foolish exaltation, constantly making unreasonable requests, asking for bicycles, etc. His memory is very defective and his speech childish. He has become very fond, when he gets the opportunity, of attiring himself in a fantastic manner, being particularly keen on pagris of grotesque design.—C. J. R. Milne, 1906.

Case—Chronic mania following prolonged indulgence in *bhang* and
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 motive

was to make himself more fit for his work. His memory was, when he was admitted, less affected than these cases usually are, and by interrogation a coherent account of his past life was obtained from him, which was subsequently corroborated by his father and friends. His father stated that the son had become mentally altered four months prior to admission, and that, having threatened his wife and mother-in-law, they left him. He was also found at the Lahore station in a state of mania, and was brought to the asylum. On admission he was in a state of great exaltation and excitement, and was evidently well pleased with himself. He talked in a loud sonorous voice, bursting out at the end of every sentence into a fit of exaggerated laughter, which lasted for a minute or more. He exhibited delusions of wealth and position. He has remained in this condition for about ten months, being at times more communicative than at others, but being easily aroused into a foolish declamation of his powers, interpolated with much amusing laughter. He is extremely proud and is solitary in his habits. His physical health remains good, but he is mentally deteriorating.—C. J. R. Milne, 1906.

2. Partial Intellectual, or Monomania.

DELUSIONAL INSANITY.

The leading character of this form of insanity, which is now generally known as **delusional insanity**, may be stated to be the affection of ideation as regards one particular only. Hence there is either only one delusion, or, in more developed cases, a series of delusions, connected together by one morbid idea (see *Case (b)*, below). The delusion may be of the most ridiculous character; the individual may believe himself to be made of glass, or to be dead, or to be some celebrated character. In the **melancholic** form of monomania the delusion or delusions are frequently of a **religious** character (religious monomania), or, as in *Case (b)*, delusions of persecution (monomania of persecution). Such delusions may lead to the commission of homicide (see *Cases (c)* and *(d)*), or to suicide. Monomaniacs, in fact, may, under the influence of their delusions, exhibit propensities

similar to those exhibited, without delusion, in the various forms of partial moral mania.

In markedly distinct cases of monomania, the individual appears to be perfectly sane on all points unconnected with his delusion or delusions, and only betray excitement or depression when these are touched upon. In such cases (especially in non-melancholic cases), the individual may appear to reason correctly and accurately on matters unconnected with his delusions, and even in matters connected with them his reasoning may be accurate, although his conclusions, being founded on false premises, are erroneous. Sometimes in these cases, particularly if the individual has any powerful motive for concealing his delusion, there may be great difficulty in detecting its existence (see *Cases (e) and (f)*). In other cases, specially advanced cases, the reasoning powers appear generally affected, so that it becomes difficult to decide whether the case is one of partial, or one of general ideational insanity. Monomaniacs are often readily imposed upon and controlled by a person affecting to believe in their delusions (see *Cases (f) and (g)*).

Case (a) — Delusional insanity.—Persecution by telephones.—M. L. G., Bengali Kayastha, aged 42 on admission in 1894, a resident of Calcutta, was formerly head clerk to the Inspector of Schools at the Presidency. Had a lawsuit with a distant cousin, P. N., which he lost, since which time, 1890, he has been insane, exhibiting marked delusions that P. N. and his friends were constantly persecuting him with electric shocks, transmitted by telephones. In 1894 he attacked P. N. with an axe, and was consequently sent to the asylum, where he has spent nearly fourteen years without the slightest mental alteration. All his troubles are due to P. N. and his telephones. Quite recently he was unable to walk because of this persecution, and had to be moved about.—C. J. R. Milne, 1908

Case (b).—Monomania of persecution; multiple delusions connected with one morbid idea.—A female patient was "perfectly convinced of the

At other times he will thrust three wires into her mouth, which leave 'a very bitter verdigris taste' thereon. She protests that she can see a 'hole like the cut of knife' in one corner of the ceiling, through which he introduces the wires. . . . She has stopped her clock and covered it up, because he used to employ his wires to make it strike some twenty times in the night, in order to disturb her." He also, she believes, delights in sending her to sleep with chloroform, which she feels dropping from the ceiling upon her cap.—Bucknill and Tuke, p. 219.

Case (c) — Religious monomania. — Homicide.—"A woman consulted a medical man as to pains in after her delivery: she was While in this state she got children in a cistern. She

the children, put them to bed, and retired herself, about 10 o'clock, but could not sleep, and between 12 and 1 o'clock it was suggested to her mind, as she says, by a black shadowy figure, that if they were in heaven they would be out of danger and better done to than she could do for them. It was still further suggested to her mind in the same way that she could easily put them into the cistern, and she at once proceeded to do so, it was better for them to die young than to grow up wicked."—*Reg. v. Wilson*, Lincoln Sum. Ass., 1864, *Taylor, Med. Jur.*, II. p. 554.

Case (d)—**Monomania of persecution—Homicide.**—"A young man who had previously had a few epileptic fits, became extremely melancholic. Being possessed with the idea that he was to be murdered in his father's house, he made frequent attempts to escape from it. . . . His father was

Case (e).—**Monomania of persecution detected with difficulty.**—"Dr. A. T. Thomson was requested to see a gentleman, whose friends were desirous of placing him under restraint, being well assured of his insanity from the supervention of uncontrollable outbreaks of temper, to which he had never previously given way, though they could find no ostensible ground in his conversation or actions which would legally justify the use of coercive measures. Several medical men had been consulted, all of whom had failed to obtain any such justification. . . . Dr. Thomson, struck with the evidence of violent passion, afforded by the damages

versation, his patient being evidently a man of great attainments,

Physiology, p. 669.

told the particular form which the malady assumed. The prosecutor, the mine He conducted with all the skill and sagacity of which he was master, for

immediately said, 'Thou has spoken truly, I am the Christ.'—Case related by Eiskine during his defence of Hadfield, Browne, *Med. Jurisp. of Insanity*, p. 290.

See
 whi
 Edinburgh, *Edinburgh Review*, 1844, p. 100.
 of expression. On inquiring after his health, Weber rose and said, 'Mr. Scott, you have long insulted me, and I can bear it no longer. I have brought a
 instantly,'
 on Scott's
 way of sett
 part of you.
 you please, we will put the pistols in the drawer till after dinner, and then arrange to go out like gentlemen.' Weber answered with equal coolness, 'I believe that will be better,' and laid the second pistol also on the table. Scott locked them both up in his desk, and said, 'I am glad you feel the propriety of what I suggested, let me only request further that nothing may occur while we are at dinner to give my wife any suspicion of what has been
 withdrew to his dressing-ro
 intimate companions, and
 ment.'—Guy's *For. Med.*, p. 188.

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 centres appear to be in a state of partial activity only, or, as in the higher form of somnambulism, in a state of full activity to one train of impressions, but inactive as regards others. In this condition, while bent in accomplishing one object, very elaborate acts may be performed, and dangerous ground traversed heedlessly which would disconcert the mind when wide awake. Hence the mere fact of the performance of such an act does not of itself indicate that the higher or intellectual nerve-centres were in full activity at the time of its performance. This is obviously of much medico-legal importance, seeing that such acts, done during a condition of partial activity only, of these higher centres, may result in the death or injury of others, and form the subject of a criminal inquiry.

If somnambulism be proved, the accused is exonerated from responsibility for any criminal act; and this is also the case if the person be suddenly roused from a deep sleep.

Case -- Somnambulist acquitted of murder.—"In 1878 a man named Fraser, in Glasgow, was tried for the murder of his child by beating it against a wall. He was acquitted on the ground of being unconscious of the nature of his act by reason of somnambulism. He was sprung from an epileptic and insane stock, his mother died in an epileptic fit, and some of his relatives were insane"—*Husband's F. M.*, p. 712.

Case.—Somnambulism.—"A hatcher's boy, about sixteen years old,

carry him within doors. While he was held in the chair by force, he continued violently the actions of kicking, whipping, and spurring. His observations regarding orders from his master's customers, the payment

delirium came on."—*Browne's Med. Jur. of Insanity*, p. 237.

"Two persons who had
night. One of them was
himself present at the
'I'll kill him!' The other,
awakened by the noise, got out of bed, and by the light of the moon
beheld the sleeper give several deadly stabs with a knife on that part
of the bed which he had just quitted."—*Taylor's Med. Jur.*, 2nd ed., II.
p. 600

Case.—A man stabbed by his brother under similar circumstances.—"A Spaniard, at twenty six, who had been a soldier, always of good conduct, and in tolerable health, was subject every spring to epistaxis, also to talking in his sleep. The spring of 1854 passed without epistaxis, and from this time, particularly during the night, he was subject to certain moral disturbance, for which purging was advised. Travelling with a brother, and sleeping in the same bed, he was attacked during the night by this excitement, fancied that his bedfellow was going to kill him, and

stances. The man was tried for the murder, but was acquitted on the medical evidence."—*Browne's Med. Jur. of Insanity*, p. 241.

Case.—A man suddenly aroused from sleep stabs another.—"A pedlar, who was in the habit of walking about the country armed with a sword-stick, was awakened one evening, while lying asleep on the high-road, by a man suddenly seizing him and shaking him by the shoulders. The man, who was walking by with some companions, had done this out of a joke. The pedlar suddenly awoke, drew his sword, and stabbed the man, who soon afterwards died. He was tried for manslaughter, and, although

his irresponsibility was strongly urged by his counsel, was convicted."—*Ib.*, p. 241

—“An eminent Scottish lawyer
 & difficulty and importance, and
 ly for several days. One night
 to a writing-desk which stood
 in his bedroom. He then sat down and wrote a long paper, which he
 carefully put by in his desk and returned to bed. The following morning
 he told his wife that he had a most interesting dream; that he had
 dreamt of delivering a clear luminous opinion respecting a case which
 had exceedingly perplexed him, and that he would give anything to re-
 cover the train of thought which had passed before him in his dream.
 She then directed him to his writing-desk, where he found the opinion
 clearly and fully written out.”—*Carpenter's Mental Phys.*, p. 593.

Case —Higher form of somnambulism.—“A banking house once gave
 to a Dutch professor of mathematics (Professor Van Swinden, of
 Amsterdam) a question to solve which required a long and difficult
 without
 tacked
 . Late
 answers,

used, and the professor himself declared that he had never thought of a
 solution so simple and concise”—*Guy's Factors of Unsound Mind*,
 p. 71.

Hypnotism or mesmerism is an artificially produced state
 which is allied to somnambulism. It is now of medico-legal
 interest chiefly with reference to rape (p. 288) or testamentary
 cases. The hypnotism trance may be induced by administering
 a dose of formaldehyde, and then waving a candle before the
 eyes of the person seated in a chair, with the head resting on a
 high pillow.

Before the introduction of chloroform it was largely used
 by Dr. J. Esdaile, L.M.S., in Calcutta, as an anæsthetic for
 painless operations. On the 4th April, 1845, he had to per-
 form an operation on a Hindu prisoner at Hooghly, and he
 tried the ‘mesmeric passes’ he had read about, and to his
 delight the patient passed into a state of deep sleep. That
 there was “a complete suspension of sensibility to external
 impressions of the most painful kind” was vouched for by the
 collector and the judge of Hooghly. Esdaile wrote an account
 of this and other cases in the now extinct *Indian Journal*
of Medical and Physical Science (May, 1845). The medical
 press declared that Esdaile was duped, but when he had
 collected 100 cases, he reported the matter to the Govern-
 ment of Bengal, who appointed a committee of four medical

in the lunatic
science. He was

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fits, and did it with considerable ability. In spite of careful watching,
he repeatedly effected his escape; was exceedingly vain, and in the

Case. General moral mania.—“An old man, aged 69, who had
last fifteen years of his life. He
impose well, write tolerable poetry
nt keeper of accounts. There was
the most homeless and trying

women and to exhibit them to those patients who were addicted to
abuse. He could not be trusted with female patients, for he would attempt
to take indecent liberties with the most demented creatures. In short, he
had no moral sense whatever, while all the fault that could be found with
his very acute intellect was that it was entirely engaged in the service
of his depravity. . . . At long intervals, sometimes of two years, this
patient became profoundly melancholic for two or three months, refused
to take food, and was as plainly insane as any patient in the asylum. It
was in an attack of this sort also that his disease first commenced.”—
Maudsley's Phys. and Path. of Mind, p. 362

Case.—General moral mania.—Viciousness and depravity.—V. B., age
about 22, admitted 16th August, 1899, into Lahore Asylum, is an
habitual criminal who has apparently never in his life maintained
himself by honest labour. While in jail for a term of imprisonment for
receiving stolen property, he was found so constantly troublesome and
given to making unprovoked assaults on the weaker prisoners, being
nithy, and utterly unamenable to reason and punishment, that he was
finally certified as a lunatic and sent here. Absolutely no previous or
family history is obtainable of a reliable nature.

Beyond a certain amount of irritability he showed no sign of insanity,

to be considered, but the whole process of which it is a part, and the impairment of the mental condition may be traced to environment or a combination of circumstances forming a new and narrowed self, incapable of deliberation and dangerously explosive on the slightest provocation; whilst there seems reason to believe that many of the explosive acts of a homicidal as well as suicidal character are attended with an imperfectly conscious and relatively mechanical condition.¹

4 Partial Moral Mania.

This form of mania only differs from the preceding variety in the fact that the morbid perversion is not general but limited to one or two particulars. Hence, in partial moral mania, the individual exhibits one or two, instead of several, morbid propensities. Under this form of mania may be classed the impulsive or explosive insanity of some writers. Different varieties of partial moral mania are distinguished according to the special propensity present, for example, homicidal mania, suicidal mania, kleptomania, pyromania, etc. Medico-legally the more important kinds are the following:—

Homicidal Mania.

Homicide, as has been already pointed out in *Cases (d)* and *(c)*, p. 363, may be the result of a *delusion*, such as the belief that the victim is persecuting the accused. Such cases, according to Ray's classification of mania, belong to intellectual insanity, usually to the partial form, and may, therefore, be called cases of '*homicidal monomania*'. In some cases, however, the homicide, or attempt at homicide, appears to be the result of an insane propensity or '*impulse*,' unaccompanied, at least so far as can be ascertained, by a delusion, and so would be classed as moral or effective mania, usually of the partial variety, and to these the term '*homicidal mania*' is commonly applied. Murder may also be committed by insane melancholics in the belief that they are saving the person from some danger, etc., by women suffering from puerperal insanity (here the victim is usually their infant), or in the frenzy of an epileptic seizure.

Case.—Homicidal mania. gradual approach.—"A young man, *et.* 25, and of gentlemanly declaring himself to be a (in Paris), begged that th charge with a view to his then explained that he was

¹ T. Clave Shaw, M.D., *Trans. Med. Leg. Soc.*, 1903, I. 31.

at the age of 28. He had previously served in the Burma Military Police and had been discharged on account of epilepsy. One day, in 1900, his cousin, several goats, . . . Since admission he has at long intervals. He is irritable and dangerously excited after one . . . At all times he is a man liable to attack suddenly, without motive or provocation, any one who may be near him. He

15th of May following he tried to strangle himself. Since then, however, the tendency to self-destruction has been less prominent.

Case.—Chronic mania with homicidal impulse.—Gopi Bhuia, a Hindu (Kaibarta) from Midnapore, admitted on February 24, 1902, having been indicted for murder but unable to stand his trial on account of his insanity. He is said to have been regarded as weak-minded from infancy, and to have some years prior to admission become addicted to ganja smoking which made him thoroughly insane. He has continued since admission in a state of restless noisy excitement. His speech is mostly foul abuse and is very incoherent. His memory is defective and his intelligence is that of a child. He is extremely liable to make sudden aggressive attacks and has frequently done so. On December 30, 1902, he rushed up to and killed an unfortunate fellow-patient before he could be restrained. He is the most dangerous insane in the asylum and his treatment is a matter of very great difficulty.—C. J. R. Milne, 1908.

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symptoms) of the existence of eccentricities (see *Cases*, pp. 369 and 373), mental disorder (see *Case*, p. 376), and it has been noticed that homicidal tendencies may coexist with a quiet exterior. In other cases, again, the homicidal act appears to be the result of a sudden and uncontrollable impulse, occurring in an apparently sane person, the commission of the act being, as it were, the only symptom of insanity exhibited, as in cases of running amok. Not infrequently the homicidal propensity of impulse appears to be connected with disordered menstruation, or with parturition, puerperal fever or with epilepsy. Not infrequently, also, it is accompanied by suicidal tendencies. Especially in cases where the symptoms of insanity are slight, importance attaches to the character of the act.

Running amok.—The word **amok** is a Malay word meaning, literally, 'frenzied.' But it is applied to the impulsive form of reckless multiple homicide often without motive. In India it is usually associated with the delirious intoxication of Indian

hemp, and is most prevalent amongst Mohammedans. In the Malay Archipelago it appears to occur independently of drug intoxication. Dr. Guillette¹ considers the Malayan form to be pathological and allied to somnambulism, the individual being rendered "subconscious by the unrestrained action of his own automatic centres," and in some respects allied to the 'procursive' form of epilepsy in which the patient starts to run. There is always, says he, (1) sudden paroxysmal homicide, generally in the male, with evident loss of self-control, (2) it is preceded by a period of mental depression, (3) there is a fixed idea to persist in reckless killing, due to an irresistible impulse of a purposive character; (4) there is a subsequent loss of memory. Another Malay observer² divided *amok* into two classes, (1) cases where the motive is revenge for a supposed or real wrong, where the assailant becomes perfectly reckless; and (2) what he describes as *orang beramok*, which requires the intervention of the medical jurist to prevent irresponsible persons suffering from the penalty of the law. As the first persons injured are sometimes strangers with whom the accused is not at enmity, and whom he could have no motive in killing, the mental condition of the *amok* murderer should be subjected to prolonged medical observation with reference to the question of responsibility.

Case.—Homicidal mania by cutting.—This man, an inmate of Lahore Asylum, has for fourteen years been constantly possessed with the desire to kill by cutting. No family history of any kind is available of a reliable nature. At the age of 32 there is a doubtful history of his having been

October, 1901, he secreted a piece of iron hoop, and with this unsuccessfully attempted to cut another lunatic's nose off. Since then, with stringent supervision, he has failed to obtain means to effect his purpose,

¹ Med Archives, Federated Malay States, 1901

² Dr Oxley, in 1842, quoted by Chaviers.

and has remained the same quiet, intelligent, well-behaved man he has always been for the last fourteen years.—G. F. W. Ewens, *Ind. Med. Gaz.*, 1902, p. 228.

The chief points usually stated to indicate homicide by an insane are,—

(a) **The absence of motive.**—*Case* below is an example of this. Sometimes there is not only an entire absence of motive, but, as pointed out by Taylor, the act is done “in opposition to all human motives.” A woman, for example, murders her own children, or a man known to be fondly attached to his wife, kills her. Caution, however, is necessary in judging from this character. In a murder by a sane person there may be an apparent absence of motive, simply because the motive has not been discovered. On the other hand, in cases of homicide by undoubtedly insane persons, a motive—often, it is true, incommensurate with the act—has existed, or has appeared to exist. Again, in cases of homicide by sane persons, especially in India, the motive leading to the crime is sometimes a very trivial one.

(b) The absence of concealment of the act.—Case below affords example of this. On the other hand, there is sometimes a considerable effort at concealment of homicide by an insane.

Case—Homicidal mania in an individual otherwise apparently sane.—
 "Will
 regue
 seen
 moth
 never
 p. 181.

(c) **The absence of accomplices.**—This character is often present in homicide by sane persons. The existence, however, of accomplices strongly indicates sanity.

(d) **Numerous murders committed at the same time.**— Little reliance can, however, be placed on this character. In homicide by insanes there is often only a single victim (see *Cases*, pp. 359, 364 (c), and 374). On the other hand, in homicide by sane persons, there are sometimes numerous victims, as in 'Running amok' (p. 374).

Absence of elaborate premeditation.—To this, however, there may be exceptions.

a shoemaker, had been a teacher in the Sunday school of Bridgman,

and there had been rumours eighteen months before the murder of his having behaved indecently towards a little girl of eleven. The prisoner was much interested in the rumour, was a disciple of Mr. Stead, took a great interest in the Criminal Law Amendment Act, and appears to have allowed her attention to be absorbed by these subjects until she became even more crazy than the general run of the nasty minded apostles of purity. She purchased a revolver and practised with it. She wrote to the deceased, expressing her regret for the mistaken attitude she had adopted towards him, and asking him to meet her in the parish schoolroom in the presence of witnesses and shake hands as a token of forgiveness. The meeting took place, and then, asking deceased to take a good look at a picture on the wall, she placed a revolver to the back of his head and shot him dead. Evidence was given of various eccentricities in the previous conduct of . . . Kent County Asylum in which the prisoner . . . their opinion the prisoner ordered to shoot the . . . the jury to stop the . . . of the speech for the defence, but before its conclusion they returned a verdict of "guilty, but insane."

This case shows the exaggerated effect that any emotional propaganda may have upon persons of unstable brain. The unfortunate woman's mind was obsessed by the pseudo revelations of Mr. Stead's pornography, and her crime was the result of her obsession. The case with which the plea of insanity was established is rather remarkable in consideration of the elaborate premeditation and contrivance exhibited. This case bears a striking relation to the Prendergast trial. The evidence of premeditation and adoption of means to ends shown by this unfortunate lunatic were of the same kind as those relied upon by the prosecution to prove the sanity and full responsibility of Richard Prendergast for the murder of Carter Harrison.—*Jour. Mental Sc.*, October, 1899.

Kleptomania, or the impulse to steal, is often present in general mental disease, though it is sometimes pleaded to excuse a theft by well-to-do people otherwise sane. In some cases theft committed by an insane is distinctly traceable to the existence of a delusion, *e.g.* the individual may believe that he is only recovering property stolen from him. This sometimes occurs as an outcome of the delusions of boundless wealth often present in incipient general paralysis. Or, again, the individual may believe that he has received a divine command to take possession of the articles he steals. In other cases, by no means common, there is no delusion, but simply a morbid propensity or uncontrollable impulse to steal or to acquire. Kleptomania is sometimes strikingly hereditary,¹ and it is alleged that it has often shown itself in women labouring under disordered menstruation, or far advanced in pregnancy.² Browne³ goes at length into the characters which distinguish

¹ Bucknill and Tuke, *op cit.*, p. 284

² Marc and others, quoted by Taylor, *Man*, p. 757.

³ *Med. Jur. of Insanity*, p. 132

theft by kleptomaniacs from theft by sane persons. A brief summary of these is as follows:—

(1) The articles stolen are such as the means of the individual would readily enable him to purchase (see *Case (a)* below) or articles of little value. (2) Some kleptomaniacs steal openly, others will willingly avow the act, or restore the goods stolen. Some, however, conceal the theft with much ingenuity. (3) Kleptomaniacs, as a rule, make no use of the articles stolen; they either throw them away or hoard them, and have no accomplices. (4) In many instances, but not invariably, the articles stolen are bright and glittering articles. *Case (a)* below, in which kleptomania was set up as a defence to a charge of theft, illustrates the points to be attended to in forming an opinion on cases in which it is alleged this form of insanity exists.

have been obtained was a confession on the part of some of his servants that he was 'sometimes peculiar.' Yet this gentleman was in the habit of appropriating 'towels.' He invariably, when visiting or on a journey, packed the towels he found in his bedroom in his portmanteau. And when he returned home, the stolen articles were, by his own directions, returned to their real owners."—Browne, *op. cit.*, p. 128.

Case (b).—Alleged kleptomania (Casper, IV. p. 308).—Frau von X.—a lady of certain rank, committed during her pregnancy theft in three goldsmiths' shops. She concealed her conduct from her husband until she was summoned after her delivery, when she confessed to him her thefts, accounting

many false and contradictory statements."—Browne, *Med. Jur. of Insanity*, p. 138.

Incendiarism.—Cases of pyromania, or morbid propensity for incendiarism, sometimes occur. Young females suffering from disordered menstruation, or hysteria, or epilepsy are said

Other forms of partial moral mania are erotomania, an uncontrollable craving for excessive sexual intercourse; it is called nymphomania in females and satyriasis in males: it may exist in the earlier stages of general paralysis and locomotor ataxia, and dipsomania, a morbid craving for intoxicants.

Examination of Alleged Insanes.

To ascertain the existence or otherwise of insanity you examine.—

1. General appearance of patient.—Especially: (a) any cranial deformity (see 'Amentia'); (b) the facial expression and gestures—these are often highly indicative of insanity, especially of its advanced or more fully developed forms; and (c) any peculiarities of dress, gait, or surroundings.

2. Bodily condition.—Note specially: (a) the condition of the digestive functions—these are often disordered in the early stages of insanity, the skin becoming harsh and dry; (b) the state of the pulse, and the presence or absence of febrile symptoms—this is important in distinguishing between insanity and the delirium of disease; and (c) the presence or absence of insomnia, restlessness, excitement, depression, or defect of speech or articulation. Bucknill and Tuke observe that in a great many cases of chronic mania the hair becomes rough and bristling. A blood tumour of the ear (hæmatoma) ending in shrivelling, the so-called asylum, or 'insane ear,' is often noticed in advanced cases.

3. History.—(1) As indicative of the cause of the disease. The existence or absence of (a) congenital defect, (b) hereditary taint, (c) habitual indulgence in intoxicants, (d) disorders, especially in females, of the reproductive organs, (e) epilepsy, or other brain affection or injury, (f) excessive sexual indulgence, and (g) mental overwork, anxiety, or sudden shock. Inquiry should also be made as to whether anything has occurred likely to induce the individual to feign insanity. It must not be forgotten, however, that sometimes insanity may arise from the anxiety of mind resulting from a criminal charge. (2) As to existence of the disease, it should be noted whether or no (a) there has been any previous attack of insanity; (b) there has been any marked alteration or change in the feelings, affections, and habits of the patient; and (c) inquiry should be made generally as to the symptoms observed at the commencement of the alleged outbreak of insanity.

Case.—Insanity due to anxiety of mind caused by a criminal charge.—A poor man, a shoemaker, was requested by two police-officers to assist them in conveying to prison two men committed on a charge of theft. The shoemaker took a gun with him, and on the order of the police-officers fired at one of the prisoners, who was attempting to escape, and wounded him severely. The shoemaker was committed to gaol as a criminal, and the event made "such an impression upon him that he became violently maniacal"—Taylor, *Med. Jur.*, II. p. 496.

4. **Mental condition and capacity.**—Inference as to this may be drawn from the patient's (1) answers to questions, (2) acts, and (3) writings. As regards (1), the patient's memory may first be tested. He may be asked, for example, his name, place of birth, as to the occupation of his parents, number of brothers and sisters or children, the date, the names of well-known persons, and may be asked to count in order from one upwards, etc. Next, his judgment may be tested; he may be asked to perform simple arithmetical operations, may be questioned as to his knowledge of the value of money, and generally as to the inferences he would draw from particular facts. While questioning him, his power of fixing his attention should be observed. Next the existence of delusions should be searched for. If these are known, the conversation should be led to them; if not, the conversation should be led to various topics in succession. Lastly, the state of the moral feelings should be inquired into by directing the conversation to the subject of the patient's friends and relatives. This testing of the mental capacity by questions is of special importance in cases of supposed feigned insanity. Except in complete amentia, advanced dementia, or possibly also in an actual paroxysm of maniacal excitement, in true insanes, consciousness, memory, and matters unconnected with a certain extent, in insanity, detected to simple questions. Care should be taken that the questions asked are not too complex, but are such as the individual under examination might reasonably, from his education and position, be expected to be able to answer

car. The answer was, "Never!"

Case (b).—Ogston relates a similar case,¹ for example, in which a

¹ Case of David Yoolow, *Lect. Med. Jur.*, p. 297.

medical witness put forward as evidence of mental incapacity the fact that an alleged imbecile could not tell how much per cent £20 interest on £1200 amounted to, though he himself (the witness), when asked to answer the same question, was unable to do so

During the course of the examination, it should be noted whether the individual, as is usually the case with impostors, appears to be trying to make himself out to be mad. True insanes will often argue with considerable ability that they are not mad. Others are conscious of their condition. A constant putting forward, however, of evidence of insanity should always be looked on with suspicion.

(2) As to the evidence of mental disorder afforded by the acts of the patient, it should be recollected that these in a true insane are the results of his disordered mental condition. Where delusions exist, his acts and antics are connected with them, even although the connection may be apparently inexplicable (see *Case (a)*). Sometimes, as Dr. Guy remarks, "the acts of the maniac evince the same forethought and preparation as those of the sane" (see *Case (b)*); and lastly, true insanes are generally easily imposed upon.

Case (a).—Acts apparently inexplicable the result of delusion.—"I expected to be guided to prayer, but a spirit guided me and placed me in a chair in a constrained position, with my head turned to look at the clock, the hand of which I saw proceeding to the first quarter; I understood I was to leave the position when it came to the quarter. Another delusion I laboured under was that I should keep my head and heart together, and so serve the Lord, by throwing myself with precision and decision head over heels over every stile or gate I came to."—(Guy's *For. Med*, p. 186, quotation from the Autobiography of a Religious Maniac)

Case (b) —Homicide by an insane; forethought and preparation shown.—"A patient confined in the Manchester Lunatic Asylum had been cruelly treated by a keeper, and in revenge killed him. He related particulars of the transaction to Dr. Haslam with great calmness and self-possession. He said, 'The man whom I stabbed richly deserved

tion of repentance, prevailed on him to release me. For several days I

the friendly intercourse was maintained between us; but as he was one day unlocking his garden door I seized the opportunity, and plunged the knife up to the hilt in his back."—Guy's *For. Med*, p. 187.

... questions.—A widow, d to annul the contract, did so thus: 1, 2, 4, 6.

7, 8, 10, 11, 13, etc. Asked how many fingers she had on each hand, she said "four." Asked how many two and two made, she said, "six." To some simple questions, such as—How many children have you? How long has your husband been dead? What did he die of? What is your daughter's name? What have you had to eat to-day? What is your clergyman's name?—she in each case gave an incorrect answer. To other simple questions, such as—What year is this? How long is it since Christmas? Where do you live? etc., her answer was, "I don't know." Asked what is the first commandment, she answered, "I am the Lord thy God." Asked what is the second, she gave the same answer; said she did not know the third and fourth. Asked the fifth, she said, "Thou shalt not honour thy father and mother."—Woodman and Tidy, *For. Med.*, p. 900, from the *Berlin Medical Zeitung*.

5. Writings of the patient frequently show evidence of the existence of mental disorder by the patient. These may exhibit incoherence, or betray the existence of delusions; but except in cases of approaching general paralysis, the legibility of the handwriting is not usually affected. Sometimes the approach of insanity is indicated by a person omitting words from his writings or spelling badly.

Feigned Insanity.

The chief points by which feigned insanity may be distinguished are:—

1. **Absence of characteristic facial expression.**—In insanity, especially in the fully developed forms usually feigned by impostors, the facial expression is characteristic. In feigned insanity, this characteristic facial expression is usually absent, or if present, is not persistent.

2. **Absence of bodily disorder.**—Bodily disorder is usually present in true, and absent in feigned insanity. The presence or absence of insomnia should specially be noted. True insanes sleep but little; impostors, exhausted by their exertions in feigning insanity, sleep soundly. Deafness and dumbness are sometimes feigned. These in true insanes are usually congenital; in feigned insanes they come on suddenly, and after the occurrence of an event likely to induce the individual to feign insanity.

3. **Sudden attack without sufficient cause.**—In true insanity, if the attack is sudden, inquiry will, as a rule, show a sufficient cause for the attack. Feigned insanity usually appears suddenly, without sufficient cause, and is generally traceable to a desire to escape punishment.

4. **Want of uniformity in the symptoms.**—In feigned insanity, the symptoms are, as a rule, not uniform with any distinct type of the true disease. The impostor, for example, mixes general mania with excitement, with advanced dementia, etc. That variation from distinct type is often present in a case of true insanity, should, however, be borne in mind.

5. **Persistent obtrusion of the symptoms.**—Impostors nearly always try to convince you that they are mad, putting forward evidence of their insanity, especially when they think they are under observation. The fact of being under observation makes little difference in the behaviour of a true insano.

In many cases, a satisfactory diagnosis between feigned and true insanity can only be arrived at by subjecting the patient to prolonged observation; but suspected lunatics cannot be detained under observation for more than fourteen days. It must not be forgotten also, that an expert witness, when called upon to give an opinion as to the mental capacity of an individual alleged to be insane, must be prepared, as in other cases, to state the grounds upon which his opinion is based.

Legal Aspects of Insanity.

In the present state of our knowledge, it does not appear to be possible to frame a thoroughly satisfactory definition of the term 'insanity.' One of the chief difficulties in the way of doing so lies in the fact that it is impossible to set up a standard of sanity. Any definition, for example, to the effect that insanity is mental imperfection, incapacity, or disorder, arising from certain causes, involves the setting up of such a standard. Such definitions, in fact, involve the necessity of our laying down a standard of mental perfection, capacity, or sanity, deviation from which shall be held to constitute insanity. Nor is the difficulty diminished by substituting for the term 'insanity,' other terms, such as 'unsoundness of mind,' 'mental aberration,' or 'mental alienation.' This difficulty of defining the conditions, however, is of comparatively little importance, for the reason that whenever a legal right, liability, or disability, arises out of the fact that an individual is insane, it does not arise simply out of the fact of the individual's insanity, but arises out of the fact that the individual, by reason of his insanity, is—or was, at a certain specified time—mentally incapacitated to a certain extent or degree. The degree of mental incapacity which must be proved to exist, in order to establish that such right, liability, or disability accrues, varies with the nature of the right, liability, or disability in question.

Hence, when in the course of an inquiry for medico-legal purposes, an individual's sanity or insanity comes into question, what was to be determined is not simply, is the individual insane, or was he insane, at a certain specified time? Were it so, a definition of insanity would be necessary.

What has really to be determined is—Is this individual or was this individual at a specified time, by reason of insanity, mentally incapacitated to a certain extent or degree? Such questions may arise in criminal cases, and also in civil cases. Again, also, the question frequently arises, whether or not the insanity of the individual is of such a nature as to justify his being placed in an asylum or under restraint.

Criminal Responsibility and the Plea of Insanity.

Every person is by law presumed to be of mental capacity sufficient to render him responsible for his acts. In criminal cases this presumption may be rebutted by proof that, at the time the act was done, the individual, by reason of unsoundness of mind, was mentally incapacitated to a certain defined extent or degree. The burden of proving this rests with those who assert it. The plea of insanity is often advanced dishonestly to escape from the legitimate punishment for their crime, or this plea is sometimes too easily accepted for sentimental reasons.

The verdicts passed on such occasions are "guilty" or "not guilty because of insanity," but a third verdict should be allowed, namely, "guilty, but insane"—Sir W. T. Gairdner, *B. Med. Assn.*, 1893.

The English law on this subject is to be found in the answers given in 1843, by the English judges, to certain questions propounded to them by the House of Lords.

These questions were put to the judges in consequence of the *McNaughten* case (see below). The object of these questions was to obtain an authoritative statement of the law for the future guidance of the courts, and the answers of the judges thereto have ever since been held to embody the law of England on the subject.

Case.—The *McNaughten* case.—In this case a man, named *McNaughten*, was tried for the murder of a Mr. *Drummond*, and acquitted on the ground of insanity. *McNaughten* was under a delusion that *Drummond* was one of a number of persons whom he believed to be

following him everywhere, blasting his character, and making his life wretched. Under the influence of this delusion he shot Drummond. McNaughten had transacted business a short time before the deed, and had shown no obvious symptoms of insanity in his ordinary discourse and conduct. — Maudsley, *Responsibility in Mental Disease*, p. 95.

These answers are also embodied in s. 84 of the Indian Penal Code, which constitutes the law of India on the subject of the criminal responsibility of insanes. This section is as follows: "Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." The effect of this section may be stated to be as follows: Suppose it to be proved that an individual has done an act which, were he sane, would be an offence—say, for example, A has killed B. Suppose, also, it to be proved that A at the time of killing B was insane. A would be entitled to an acquittal if he, at the time of killing B, was by reason of insanity mentally incapacitated to one or another of the following degrees:—

1. To such a degree as to render him "incapable of knowing the nature of the act"; as, for example, if A in killing B did so under the insane delusion that he was slaying a wild beast or breaking a jar; or

2. To such a degree as to render him incapable of knowing that he was "do

as, for example,

insane delusion

killing him; for in that case A's insanity would render him incapable of knowing that he was acting contrary to law, seeing that A, were his delusion true, would be justified by law in killing B.

On the other hand, A would not be entitled to an acquittal if all that was proved in regard to his insanity was that he killed B under the insane delusion that B had blasted his character; for in that case A, even were his delusion true, would not be justified by law in killing B; and would be presumed, the contrary not being shown, to know the nature of his act, and also that he was acting contrary to law.

Another point requiring consideration is as follows:—There is a general consensus of opinion among writers on insanity, 1st, that one effect of insanity may be a weakening of the affected individual's power of self-control; 2nd, that in some cases the power of self-control is totally lost, the result being the production of an uncontrollable impulse, i.e. an impulse which nothing short of mechanical restraint will control (*Case*, p. 374), to do certain acts; and 3rd, that such weakening or

total loss of the power of self-control may occur, both in insanity accompanied by delusions, and in insanity unaccompanied thereby. The question therefore arises:—Suppose A to have killed B, and the only thing proved about A's insanity is that, by reason of insanity, A's power of self-control was, at the time he killed B, weakened or entirely lost, what would be the legal effect?

To this question it may be answered:—

1. That any weakening short of total loss of power of self-control would not entitle A to an acquittal, either under Indian or English law.

2. That, according to the Indian law, total loss of power of self-control would not entitle A to an acquittal, except the court consider it proved that, by reason of such total loss, A at the time of doing the act was, in the words of the section, "incapable of knowing the nature of the act, or that he was doing what is either wrong or contrary to law."

3. As regards the law of England on this last point, Sir J. F. Stephen¹ states that it is doubtful whether or no an act is a crime if done under the following circumstances: by a person suffering from mental disease, who at the time of doing the act was by such disease totally prevented from controlling his own conduct.

Hence, in a case where the question of criminal responsibility is concerned, a medical witness should not simply direct his examination towards ascertaining whether the accused is insane or not. He should in addition endeavour to form an opinion as to whether, by reason of insanity, the accused is mentally incapacitated to the degree specified in s. 84 of the Penal Code. He must, however, recollect that the real question at issue is the mental state of the individual at the time he committed the act. Hence he must be prepared if called upon to give his opinion as to this, and, as in other cases, must also be prepared to state the grounds on which his opinion is based. It may happen that, in order to arrive at a correct opinion, he has to take into consideration not only (1) facts which he has himself observed, but also (2) circumstances which he has heard deposed to in evidence, or of which he has been informed. It is obvious, however, that any opinion based upon circumstances not within the knowledge of the witness is worthless, unless such circumstances are admitted or proved to be true in fact; and such opinion, therefore, should be given on the hypothesis that these circumstances really exist, and should be stated to depend on such hypothesis.

Nevertheless, it should be remembered that few insane

¹ *Digest of the Criminal Law*, p. 21.

persons are wholly irresponsible. The insane in their routine treatment in asylums are punished for fits of temper or committing nuisances by withdrawal of privileges such as stoppages of tobacco, forbidding him the weekly dance, or the infliction of pecuniary fines. The degrees and extent of immunity to be granted to an insane for his misdeeds have been thus formulated by Dr. Mercier —

(1) All lunatics should be partially immune for all their misdeeds; (2) Every lunatic should be wholly immune for certain misdeeds; (3) Very few lunatics should be wholly immune for all misdeeds—corollary—the plea of insanity, if established, did not necessarily involve the total immunity of the accused from punishment, it did necessarily involve his partial immunity, and (4) that in order to establish the plea of insanity it was necessary to prove the existence in the accused of one or more of the following mental conditions—(a) exonerating delusion; (b) such confusion of mind that the accused was incapable of appreciating, in their true relations, the circumstances under which the act was committed or the consequences of his act, (c) extreme inadequacy of motive; (d) extreme imprudence, and (e) the non-concurrence in the act of the volitional self. *Brit. Med. Assocn.*, 1893

Those who in a fit of intoxication by alcohol or drugs commit crime during their temporary mental aberration are not allowed the privileges of the plea of insanity.

Validity of Consent.

In certain cases the fact that an individual has given a valid consent to suffer what has been done to him, affects the question of the criminality of the doer. But by s. 90 of the Indian Penal Code a consent is invalid if given by a person who "from unsoundness of mind or intoxication, is unable to understand the nature and consequence of that to which he gives his consent." Hence, in certain cases, the question may arise whether a consent proved, or admitted to have been given, was or was not invalidated by the fact that at the time of giving it the giver was mentally incapacitated to the degree specified in this section.

This question may arise in rape cases, for the consent of a female to sexual intercourse may be invalid by reason of her

s. 90 of the Indian Penal Code, may yet be capable of giving a consent to sexual intercourse, sufficient to exculpate an accused from a charge of rape, and reduce the offence committed to a misdemeanour (see 'Rape').

The same question may arise in cases where death or hurt

has been caused By the law of India, if a person over the age of eighteen suffers death or harm from an act done to him with his valid consent, the fact that he so consented may have the effect of reducing the offence committed from murder to culpable homicide not amounting to murder;¹ or may even, if the act be one coming under the description of s. 87 of the Code,² absolve the doer of the act from all criminality.

It should also be pointed out that, by s. 305 of the Indian Penal Code,

Capacity of an Accused to make his Defence.

In criminal cases the question may arise: Is, or is not, the accused "of unsound mind, and consequently incapable of making his defence?" (See ss. 464 and 465, Criminal Procedure Code.) Obviously in such cases an expert called upon to examine the accused should direct his examination, not simply to the question whether the individual is or is not insane, but to the question whether or no the individual is mentally incapacitated to the extent indicated in these sections.

Competency as a Witness.

In civil cases, the law of India on this subject is embodied in s. 118 of the Indian Evidence Act. The 'explanation' attached to this section is as follows:—

"A lunatic is not incompetent to testify unless he is prevented by his lunacy from understanding the questions put to him and giving rational answers to them"

The 'competency' of a witness to testify is a matter quite distinct from the 'credibility' of his evidence. Hence it may

¹ Section 300, Exception 5, of the Indian Penal Code is as follows:—
"Culpable homicide is not murder when the person whose death is caused, being above the age of eighteen years, suffers death or takes the risk of death with his own consent."

person who has consented to take the risk of that harm."

be that a lunatic who has been declared by the court competent to testify, may give evidence which the other circumstances of the case may show ought not to be believed. As in the case of testamentary capacity, no amount of disease of the nervous system not affecting the mind renders an individual incompetent as a witness. Thus, by s. 119 of the same Act, "a witness who is unable to speak may give his evidence in any other manner in which he can make it intelligible, as by writing or by signs; but such writing must be written and the signs made in open court. Evidence so given shall be deemed to be oral evidence."

Testamentary Capacity.

By 'testamentary capacity' is meant capacity to make a valid will. To invalidate a will on the ground of the insanity of the testator, it must be proved that at the time the will was made, the testator was mentally incapacitated to a certain extent or degree. This degree may be defined to be that he either (1) did not know the nature of the act he was performing, or (2) was not fully aware of its consequences; or (3) has made a disposal of his property which he would not have made had his mind been sound, under the influence of a delusion, or of a disorder of the mind, perverting his affections, or sense of right¹ (see cases *Banks v. Goodfellow* and *Smee v. Smee*, noted below).

Case—Validity of will by insane.—Cockburn, C.J., in delivering

he ought to give effect; and, with a view to the latter object, that no disorder of the mind should poison his affections, pervert his sense of

made under such circumstances should not be upheld." . . . "In the case before us two delusions disturbed the mind of the testator—the one,

¹ Undue influence exerted on a person of feeble intellect may be held to render a will invalid, although the feebleness of intellect considered *per se* be insufficient to invalidate it.

circumstances, then, we see no ground for holding the will to be invalid"—*Banks v Goodfellow*, L. R. 5 Q. B. 549; Browne, *op. cit.*, p. 191, and Maudsley, *Respons. in Mental Disease*, p. 117.

Case—Testamentary incapacity.—In this case two wills were pro-

time of the execution. The burden of proof rests upon those who set up

v. The Corporation of Brighton, L. R. 5 P. D., p. 84.

A person who is insane therefore may make a valid will provided, at the time of making it, he was not mentally incapacitated to the degree specified above (see *Case*, p. 389). A valid will may, of course, be made by a lunatic in a lucid interval. Obviously, however, the shorter the alleged lucid interval, the greater the caution which should be exercised in accepting evidence of its having occurred. Mere eccentricity will not invalidate a will, nor will any disease of the nervous

system not affecting the mind. For example, a person speechless and paralyzed from apoplexy may (his mind being unaffected) make a valid will. A medical man, in examining into the testamentary capacity of an individual, might ask him to repeat the principal provisions of his will, and explain their action. Ability to do so would show that the testator understood the nature, and was aware of the consequence, of the act he was performing. The existence of delusions, etc., likely to affect the provisions of the will should, of course, also be inquired into.

Capacity to manage Own Affairs.

When a person is alleged to be of unsound mind and incapable of managing his affairs, an inquiry into the truth of this allegation may, on proper application, be ordered by a court so empowered. On such incapacity being proved, the individual may be deprived of the control and management of his property,¹ and a person appointed to manage it for him. The courts are also empowered to make suitable provision for the protection² of the individual, e.g. by appointing a person to take care of him. Formerly in England the usual procedure in such cases was to order—under what is technically called a writ "*de lunatico inquirendo*"—an inquiry to take place before a "commission in lunacy", lately, however, the proceedings have been much simplified. In India the conduct of proceedings of this nature is provided for by Act IV. of 1912.

In all such cases the question at issue is not simply, whether or not the individual is insane or sane, but whether or not he is mentally incapacitated to such a degree as to render him incapable of managing his affairs. That this is so must always be borne in mind while examining alleged insanes in these cases. No general rule can be laid down as to what should, in these cases, be held to constitute incapacity. Where doubt exists, it should be given in favour of sanity, i.e. in favour of the supposition, from which, if established, disability does not arise. It may, however, be pointed out:—

1 That in cases of complete amentia, advanced dementia, and general intellectual mania, the individual is obviously incapacitated.

2 That in partial intellectual mania, an individual may be incapacitated or not, according as to whether his delusion does or does not interfere with his capacity. For example, an

¹ Placed under 'interdiction' is the technical expression.

² Protection is distinct from restraint (see 'Imposition of Restraint,' p. 391).

individual may believe himself to be made of glass, and yet be perfectly competent to manage his affairs.

3. That in moral mania, especially partial moral mania, the mental disorder may well be of such a nature as not to interfere with the individual's capacity.

The cases which present most difficulty are usually cases of incomplete amentia, especially the less-developed form (moral imbecility). In such cases very great conflict of opinion often exists among the expert witnesses as to the individual mental condition and capacity. This was so in the Windham case, p. 351. Lastly, it may be remarked that defective memory arising from old age does not, *per se*, constitute incapacity. "A defective memory in an aged person, taken alone, proves nothing."¹

Validity of Contracts.

It may be sought to invalidate a contract on the ground of the insanity of one of the parties thereto. To succeed, two things must be proved, namely: (1) That the insanity existed at the time the contract was entered into, and (2) that by reason of insanity the contracting party was then mentally incapacitated to a certain extent or degree, namely, that he was incapable of "understanding it, and of forming a rational judgment as to its effect upon his interests" (Indian Contracts Act [IX. of 1872], s. 12).

According to the law of England, marriage is a contract. Hence a marriage may be declared null and void on the ground of the insanity of one of the parties thereto at the time of entering into it which must be stated may be stated contract and of the responsibilities and duties it creates" (see case *D. v. D.*, below). Weakness of intellect coupled with undue

¹ Judgment in *In re Toplis*, *Taylor, Med. Jur.*, II. 524.

² Browne, *Med. Jur. of Insanity*, p. 7.

³ *Ib.*: *Molten v. Zamroux*, 4 Exch. 17.

influence has been held to
marriage (see *Case* below);
the marriage, may be one of
the court.

be attached to the word 'understand.' If I were to attempt to analyze
this expression, I should encounter the same difficulties at some other

exchanged is not sufficient. The mind of one of the parties may be
capable of understanding the language used, but may yet be affected by
such delusions, or other symptoms of insanity, as may satisfy the tribunal
that there was not a real appreciation of the engagement entered into."—
D v. D., otherwise *M.*, *Times*, 11th March, 1885

influence used"—Woodman and Tidy, *For Med.*, p. 890, and Aber-
crombie, *Students' Guide to Med Jur.*, p 169.

Aphasia in relation to testamentary capacity —The question
whether a person suffering from aphasia is capable of making
a will, will depend upon the particular case. Each case must
be judged on its own merits.

It must be laid down as a general principle that no one
could make a will who did not possess the power of understand-
ing and producing language of some sort. In order to make a
will it was necessary for an individual to be able to communi-
cate to others by means of some form of language what he

would like to
 be a will if a
 that he wanted

be a will if a person gave directions by word of mouth. A person must be capable of understanding language, so that he knew either what he said or what was read to him. That implied that he could hear and understand words, if he could not read or understand pantomimic language, but if he could read and understand what he read, then it was not necessary for him to hear or understand pantomimic language. Given that a person understood what was in a document, it was not necessary that he should be able to speak in order that he might execute a testamentary deed. He might indicate what he wished by means of writing, or by pantomime, or in other ways. A complete case of auditory aphasia, which implied word deafness and word blindness, would be incapable of making a will, because, not being able to understand any form of language, he would, in all probability, not be able to communicate his wishes by producing any form of language. From a consideration of the whole subject he had come to the conclusion that organic disease of the brain might render a patient incapable of making a will, and that some forms of aphasia might be produced also as one of the symptoms of the organic disease; that some forms of aphasia might render a patient incapable of will making; that auditory aphasia, if well marked, would incapacitate a patient from will-making; and that some other forms of aphasia, such as pictorial word blindness, pictorial motor aphasia, and graphic aphasia, might render a patient incapable of making a will, although he was not necessarily mentally incapable.—Dr. W. Eider, *Brit. Med. Assocn.*, 1898.

Imposition of Restraint and Lunacy Certificates.

When an individual by reasons of unsoundness of mind is mentally incapacitated to a certain extent or degree, restraint may be lawfully imposed upon him. This restraint may be either immediate, or may be imposed (after certain conditions have been complied with), by relegation to an asylum. Hence in regard to the imposition of restraint, we have to consider three questions: (1) What degree of mental incapacity justifies the imposition of immediate restraint? (2) What degree of mental incapacity justifies the imposition of restraint by relegation of the individual to an asylum? and (3) What are the conditions which must be complied with before an insane person is relegated to an asylum?

Degree of Mental Incapacity justifying Immediate Restraint.

By the common law of England a person of unsound mind may be lawfully restrained from inflicting physical injury on himself or others. In a person of unsound mind from injuring himself, of the Indian Penal Code, relating to acts done for a person's benefit (see ss. 89 and 92). Probably, also, these exceptions would be held to extend to such restraint as might be necessary to prevent an individual inflicting injury on others. Hence the degree of mental incapacity which, in a person of unsound mind, justifies the imposition of immediate restraint, is mental incapacity to an extent which renders him dangerous to himself or others. Immediate restraint can, however, only be lawfully imposed, either (a) with the consent of the person having lawful charge of the insane individual, or (b) without such consent if the circumstances of the case are such, that the consent cannot be obtained in time to prevent danger. Further, immediate restraint thus imposed is only lawful so long as the danger exists.

from disease, a medical man must recollect that, from the nature of the case, the danger is liable to cease suddenly, and that restraint continued after danger has ceased may be a ground of action against him.

Degree of Mental Incapacity justifying sending to an Asylum.

By the law of both India and England, a medical man in relegating an insane person to an asylum, must certify that the individual is insane, and that he is "a proper person to be taken charge of and detained under care and treatment."

Obviously a proper person to be detained under care in an asylum is one, who being insane,¹ is dangerous to himself or others, and medico-legal writers are agreed that this extends also to one who by reason of insanity is likely to injure his own property, or the property of others. Taylor² infers that

¹ Not simply suffering from delirium of disease, which renders him a fit subject for a hospital, not for an asylum

² Taylor, *Manual*, p. 709.

relegation to an asylum simply for the purpose of treatment is not justifiable, but from the remarks of Lord Coleridge, C.J., in the case of *Neave v. Hatherley* (see below), it would appear that relegation to an asylum simply for the purposes of treatment is justifiable in cases when the circumstances are such that efficient treatment cannot be employed unless the individual is so relegated.

Case—**Legal justification of restraint.**—In this case Lord Coleridge, C.J., said that the examination of a person previous to placing him in an asylum ought to be "a real inquiry, a real weighing and sifting of evidence, a real examination, a real serious and solemn exercise of judgment," in order to ascertain whether an individual came within the definition of the statute of "a lunatic, idiot, or person of unsound mind, and a proper person to be taken charge of and detained under treatment. He emphatically dissented from the Attorney-General (for the plaintiff), that unless every other means had first been exhausted a person ought not

making provision for such early treatment of relations who might be unsound in mind, while relegation, at an early stage, to a well-appointed asylum was calculated to have the best results."—*Neave v. Hatherley*, Q. B. D., *Times*, 3rd August, 1885.

It may further be pointed out that when restraint by relegation to an asylum has been lawfully imposed, the responsibility for alleged unnecessary continuance of such restraint, no longer rests with the medical practitioner under whose certificate the restraint was originally imposed.

Admission to Asylums in India.

When a medical practitioner finds that a patient is suffering from insanity and is satisfied he should be sent to an asylum either for treatment or to prevent him injuring himself or others, or perhaps to prevent him destroying property or squandering his estate, it is important the practitioner should know what steps to take. The doctor is also frequently asked by the relatives or friends of a lunatic what steps they must take to have him admitted to an asylum. It will not add to his professional reputation if he has to admit he does not know, or if the instructions he gives are incorrect. In the case of a private patient in India the following is the procedure:—

After consulting the relatives as soon as the practitioner is satisfied from personal observation that the patient is a lunatic and a proper person to be taken care of, and detained in an asylum, he draws up a certificate, "Form 3" (see Appendix).

(a) Note particularly that his examination must be made and his opinion formed *separately from any other practitioner*.

(b) Note the words, "FACTS indicating insanity observed by myself," and be careful not to enter here anything but facts, and only those you have personally observed. Then advise the relation to call in another practitioner—either you or he must be a gazetted medical officer in the service of Government—to draw up a certificate of insanity on another "Form 3."

The relative, if possible the husband or wife, must obtain Form I, an "Application for Reception Order" (see Appendix), and correctly fill it in and the attached "Statement of Particulars"

If there be no near relative, or if the near relatives be under 21,"

to the superintendent of the asylum to which it is desired to admit the lunatic, asking if he has accommodation, specifying what scale of accommodation is desired. It is well also to indicate the nature of the insanity, such as a "docile idiot," a "homicidal maniac," a "suicidal melancholic," etc.

The relative, or, in his default, the friend or guardian, then takes to an authorized magistrate—

1. The lunatic.
2. The Form of Application.
3. The two medical certificates, Form 3 (one must be given by a gazetted officer)
4. The answer of the superintendent of the asylum¹

¹ (1) This is not necessary in the case of "a lunatic who is dangerous and

below the rank of an Inspector, or who is in charge of a police station, who has reason to believe such person is a lunatic, may arrest him.

(4) Or if he has reason to believe he is dangerous by reason of lunacy, he SHALL arrest him and have him placed forthwith before a magistrate. The

periods not exceeding ten days at a time, up to a total period of thirty days from the date on which he was first brought to the magistrate

5 A certificate from a medical man to the effect that the lunatic "is in a fit physical condition to travel to the asylum."

If the lunatic be violent or obstreperous or in such a condition that the visit to the magistrate is likely to be harmful or inadvisable, the magistrate can, and should, if satisfied with the evidence, dispense with the lunatic's personal attendance.

Note.—The Act distinctly orders "The petition shall be considered in private." Chap. II., para 9. Many magistrates are in the habit of holding the inquiry in open court to the great confusion and humiliation of the relations. This frequently leads to painful exhibitions on the part of female lunatics before a ribald audience, and should never be permitted.

According as the magistrate is satisfied or not with the evidence he either issues an "Order for Reception" into the asylum or dismisses the petition.

Safeguard to preserve Liberty of Non-Insanes.

In England, France, Germany or Austria, it is a *criminal offence* for any officer of an asylum, or any one in any way in partnership or relationship by blood or otherwise with such an officer, or person having any pecuniary interest or whose relation or partner has any interest in such an asylum to sign a certificate of lunacy.

In India, though no legal offence, it is extremely undesirable that certificates (Form 3) should be given by an officer of an asylum when any other gazetted officer is available.

The principle which underlies the European law is that should any certifying medical man through carelessness, ignorance, through corruption or assigning persons, intentionally or negligently, which deprives an individual of his liberty, immediately after admission his diagnosis is subject to the criticism and observation of the expert officers of the asylum, who thus constitute a veritable "Court of Appeal," and will without unnecessary delay rectify the error of the certifying practitioner.

If, however, the certifying surgeons be one or both, also the law in other countries.

If their certificates be based on careless observation, or on errors in diagnosis, only a man of absolute probity could be

expected to correct his error by getting the patient discharged forthwith. The average individual might be inclined to postpone the correction of his mistake for some time "to save his face."

Some years ago an inquiry showed that of a total of 58 inmates of an asylum, 56 were admitted on the certificate of the superintendent, the second certificate being in many cases signed by his assistant. This asylum was situated in a city having at least a hundred medical practitioners, and a dozen gazetted officers.

Serious Obligations on Filling up Lunacy Certificates.

From the above considerations it is evident that even examining a patient previous to filling up and signing such a certificate, a medical man is bound to exercise extreme care. The social stigma which attaches to any person who has been detained in an asylum is a terrible infliction to a sensitive mind, and makes it necessary that no case should ever be sent there without due cause, and that every safeguard should be taken to prevent the possibility of a sane person being incarcerated in an asylum. As remarked by Lord Coleridge, his examination should be a "real inquiry, a real weighing and sifting of evidence, a real serious and solemn exercise of judgment." Negligence or want of care on his part (not simply an error in judgment) renders him liable to be cast in damages, on an action being brought against him (see *Hall v Semple*, below). Obviously, a medical man, unless he has himself observed facts indicating insanity in the patient, is not justified in signing such a certificate; for to rely solely on the statements of others in such a case amounts to culpable negligence.

Case—Negligence in filling up a certificate of lunacy—heavy damages (*Hall v. Semple*, 3 F. & F. 337)—In this case the plaintiff had been discharged from an asylum on the ground of informality in the certificate. This certificate was dated July 29, but the visit and examination were made on June 13. The defendant was one of the medical men who had signed a certificate of the plaintiff's insanity. The evidence, however, went to show that Hall, although a very bad tempered man, was not really insane, and that the defendant had relied too much on the statements of the wife and other interested persons. Compton, J., in summing up the case to the jury, said "The principal questions to which I desire to direct your attention are these first, whether you think that he (the defendant) signed the certificate untrue in fact, negligently and improperly, and without making proper and sufficient inquiries. It will

Further, the facts relied on and embodied in the certificate as facts indicating insanity must be facts which really do so. Numerous instances are quoted by Taylor,¹ on the authority of Dr. Millar, of certificates filled up with facts other than "good facts," or facts really indicating insanity. Some of these consist of mere statements of the existence of peculiarities of appearance or temper, not of themselves sufficient to show the existence of insanity, *e.g.* Has an insane appearance, or is violent in temper and very abusive, or refuses to take medicine. Others, again, are statements either to the effect that the individual labours under delusions, without specifying precisely what these delusions are; or statements to the effect that the individual labours under a particular belief, such as from its nature may possibly be true, unaccompanied by any definite statement to the effect that such belief has been inquired into and found to be untrue. A fact to be a good fact really indicating insanity, must either clearly show the existence of a delusion, or the existence of such conduct as cannot be accounted for on the supposition of sanity.

All the asylums in India are (1914) Government institutions, although the law permits of licensed private asylums. Private patients may be (1) Voluntary Boarders, (2) Patients admitted by "Reception Order on Petition," and (3) Patients committed by Presidency High Court or District Court after inquisition.

The following list of the present Government asylums in India may be useful for reference—

In BENGAL PRESIDENCY, (1) Bhowanipore; (2) Berhampur Central; (3) Patna. In ASSAM, (1) Dacca; (2) Tezpur. In BIHAR and ORISSA, Patna. In UNITED PROVINCES, (1) Agra Central Asylum; (2) Bareilly; (3) Benares. In the PANJAB, Lahore Central. In BURMA, (1) Rangoon Central, (2) Miihi. In MADRAS PRESIDENCY, (1) Madras Central; (2) Calicut; (3) Vizagapatnam. In BOMBAY PRESIDENCY, (1) Naupada Thana; (2) Colaba; (3) Ratnagiri; (4) Ahmedabad; (5) Hyderabad (Sind); (6) Dharwar. In the CENTRAL PROVINCES, (1) Nagpur; (2) Jabbalpur. Of these only Bhowanipur, Agra, Lahore, Rangoon, Madras, and Yerrowda admit Europeans.

With the admission of the lunatic into the asylum the

¹ Taylor, *Med. Jur.*, II. p 512.

responsibility of the medical jurist ceases. The question as to the care and the ultimate release or otherwise of the lunatic rests with the asylum authorities.

Specimens of the necessary forms are given in Appendix XI.; for further particulars regarding admission to and detention in Indian asylums of private and public patients, the "Indian Lunacy Manual of 1913," by Major R. Bryson, should be consulted.

CHAPTER XIX.

LEPROSY IN RELATION TO THE LAW.

[BY ARTHUR POWELL,

Inspector of Lepers, Bombay]

ALTHOUGH the Lepers Act was passed in the year 1898, and its provisions extend to the whole of British India, it does not come into force in any part thereof until the Local Government has declared it applicable thereto. The Act has gradually been put in force so that now there are few districts to which it does not apply.

The Act provides not only for the segregation and treatment of pauper lepers, but also for the control of lepers following certain callings. The object of law is to segregate such lepers as are capable of disseminating the contagion of leprosy and so protect the public.

A "leper" within the meaning of the Act is defined as "any person suffering from any variety of leprosy in whom the process of ulceration has commenced."

It will be readily seen that this definition is by no means scientific. The ulceration need not be leprous ulceration. Any form of ulcer, whether arising from trauma, such as abrasion or wound, from varicose veins, vaccination, etc., is sufficient to bring the leper within the Act. Further, the ulcer may have completely healed at the time when the leper is arrested.

Probably the most dangerous lepers are those in whose nasal secretion leprous bacilli are found by the million. The writer in such cases often fails to observe any ulceration. If he does not personally observe ulceration or scarring, he cannot certify the leper as a leper within the meaning of the Act.

Certain pathologists maintain that the presence of leprosy bacilli and leucocytes in the nasal secretion is sufficient evidence of "ulceration." If this be so they must include gonorrhœa and all catarrhal conditions under the heading of "ulceration."

Under the Act any police officer is empowered to arrest without warrant any person who appears to him to be a pauper leper.

A "pauper leper" is defined as a "leper (a) who publicly solicits alms or exposes or exhibits any sores, wounds, bodily ailment or deformity with the object of exciting charity or of obtaining alms, or

(b) who is at large without any visible means of subsistence."

A person so arrested must be taken without unnecessary delay before an Inspector of Lepers, who if he finds he is not a leper gives him a certificate to that effect and at once releases him.

If the Inspector finds the arrested person is a leper as defined by the Act, he gives a certificate to that effect. The leper is taken to an authorized magistrate, who, if satisfied with the evidence, commits him to an asylum to be detained.

The Act also gives the Local Government power to order that no leper within any gazetted area shall—

- (a) Personally prepare for sale or sell any article of food or drink or any drugs or clothing intended for human use,
or
- (b) bathe, wash clothes or take water from any public well or tank, or
- (c) drive, conduct, or ride in any public carriage plying for hire other than a railway carriage, or
- (d) exercise any trade or calling which may by such notification be prohibited to lepers

LIFE ASSURANCE AND ACCIDENT COMPENSATION.

CHAPTER XX.

LIFE ASSURANCE.

MEDICAL men are associated with life insurance companies as medical advisers or as medical examiners, in both of which capacities it is the duty of the physician to detect any unsatisfactory deviation from the normal standard of health of the applicant, and any attempt by the applicant to conceal any unsoundness, and to enable the company to appreciate the extent to which the unsoundness may shorten life.

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purposes, in which an individual enters into an agreement with a company to pay them each year he lives a certain fixed sum, or 'premium,' in return for which the company issue a 'Policy of Assurance,' or undertaking to pay a certain fixed sum on the death of the assured, whenever this may happen.

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For a given sum, payable at death or at a fixed age, the yearly premium to be paid by the assured must obviously be more or less, according to his 'expectation of life,' that is, according to the number of years he may reasonably be expected to live.

An individual's expectation of life depends (1) on his age, and (2) on his freedom or otherwise from any special influence tending to shorten his life. If no such special influence exists, the individual's expectation is said to be normal. Hence

arises the general question, on the answer to which the ordinary scale of premium rates of assurance companies must obviously be based, namely—(1) What is the normal expectation of life at various ages? But an individual seeking to assure may be subject to some special influence tending to reduce his expectation of life, and hence two other questions arise, namely—(2) What are the special influences which tend to shorten life, and to what extent do they do so? and (3) How is the existence, in any given case, of influences tending to shorten life ascertained?

The Normal Expectation of Life at Various Ages.

The expectation of life is calculated from the general death-rate which, being fairly well fixed in a country like England, gives a fairly fixed expectation of life for different ages amongst individuals subject to the same conditions as those to whom the statistics refer. The following is one of the most recently published tables showing the expectation of life for men in England.

EXPECTATION OF LIFE FOR MEN IN ENGLAND¹

Completed age	Years.	Completed age	Years	Completed age	Years.	Completed age	Years
0	39 01	32	31 42	56	15 56	80	4 03
5	40 71	33	30 74	57	15 26	81	4 00
10	47 03	34	30 07	58	14 58	82	4 41
11	46 31	35	29 40	59	14 10	83	4 17
12	45 54	36	28 73	60	13 53	84	3 95
13	44 70	37	28 06	61	12 96	85	3 73
14	43 90	38	27 39	62	12 41	86	3 53
15	43 18	39	26 72	63	11 87	87	3 34
16	42 40	40	26 06	64	11 34	88	3 16
17	41 64	41	25 39	65	10 82	89	3 00
18	40 90	42	24 73	66	10 33	90	2 84
19	40 17	43	24 07	67	9 82	91	2 69
20	39 48	44	23 41	68	9 36	92	2 55
21	38 80	45	22 76	69	8 90	93	2 41
22	38 13	46	22 11	70	8 45	94	2 29
23	37 46	47	21 46	71	8 03	95	2 17
24	36 79	48	20 82	72	7 62	96	2 06
25	36 12	49	20 17	73	7 23	97	1 55
26	35 44	50	19 54	74	6 85	98	1 55
27	34 77	51	18 90	75	6 49	99	1 76
28	34 10	52	18 28	76	6 15		
29	33 43	53	17 67	77	5 82		
30	32 76	54	17 05	78	5 51		
31	32 09	55	16 45	79	5 21		

¹ From *Bowen's Manual* English Experience, No 3 Males.

These are actuarial facts, based on an enormous number of fixed data and worked out by mathematicians. And on such tables assurance companies base their ordinary British premium rates for assuring the lives of men resident in Great Britain whose expectation of life is normal. Some insurance companies allow a slightly higher estimate than in this table. Lives deviating from the normal standard of health are 'loaded' with an extra premium if accepted.

PURE, OR 'UNLOADED,' 3 PER CENT PREMIUMS.

The 'pure or unloaded 3 per cent premium' is the sum which, if paid yearly during the period of expectation, will, at 3 per cent. interest, amount at the end of that period to the sum assured. Assurance offices, of course, add to the 'unloaded premium' a certain percentage to cover cost of management and profit.

Age	Expectation of healthy male lives from experience of twenty life offices in England	Unloaded 3 per cent premium in sterling per £100 assured	Unloaded 3 per cent premium stated as 1 percentage on the sum assured.
20	42 06	1 8 7	1 430
25	38 44	1 12 6	1 625
30	34 68	1 17 7	1 880
35	31 03	2 3 10	2 190
40	27 40	2 11 9	2 583
45	23 79	3 2 3	3 112
50	20 31	3 16 0	3 800
55	16 93	4 14 6	4 725
60	13 83	5 19 9	5 993
65	11 01	7 14 8	7 705

For women in Europe the expectation of life is greater than for men by about three years all through, except during the child-bearing period, when it is somewhat less.

this number, 25; the net result is the probable duration of life—67 years.

For India although no authentic official tables have yet been published showing the normal expectation of life amongst natives of India, owing to the Indian birth and death statistics

for native lives being still incomplete and untrustworthy, the latest results by the medical adviser of a large insurance company in India are summarised in Appendix XII. On the expectancy of native lives in India, as compared with European lives, another Indian insurance officer wrote:—

of Native houses are the rule, and cholera and diphtheria are common diseases."

"Again, another well-known fact is that diabetes is a very common disease amongst middle-aged Natives who are in easy circumstances, in a ratio greatly in excess of that which obtains among Europeans. It is not so rapidly a fatal disease as in Europe, but it shortens life most assuredly." . . . "The same remarks apply to the poorer classes of Eurasians and Armenians and Jews who live under bad, insanitary conditions" . . . "I

increasing the risk of assurance."*

The rates, however, at which one of the principal assurance companies in India assures healthy native lives, appear to correspond roughly to an expectation—between twenty and sixty—of two-fifths of the difference between ninety and the age: *e.g.* at age thirty the expectation apparently calculated on is about twenty-four years.

For European and Eurasian lives in India the expectation of life has been worked out in some detail (see Appendix XII, also the following table), from which the extent by which the expectation of healthy Europeans is reduced by residence in India may be arrived at approximately. The expectation shown in B, it will be observed, corresponds approximately to half the difference between the age and eighty-six (not two-thirds of the difference between the age and eighty)

TABLES OF EXPECTATION OF LIFE IN INDIA.

A. Table of expectation of life compiled by J Westland, Esq., Beng C.S., from the experience of the Bengal Unconquered Civil Service

* *Ind. Med. Gaz.*, 1889, p 311

Family Pension Fund; European and Eurasian lives, period of observation, 1837 to 1862 This is based wholly on Indian experience.

B Table of expectation of life compiled by A. F. Cox, Esq., Mad. C S, from the combined mortality statistics of the Bengal, Madras, and Bombay Civil Services; Europe: Bengal, 1850 to 1872; Madras, number of lives under observation Bombay, 700. This is based on But see Appendix XII.

Age	Expecta- tion A	Expecta- tion B	Age	Expecta- tion A	Expecta- tion B	Age	Expecta- tion A	Expecta- tion B
20	—	33 65	42	17 86	22 12	62	7 93	11 39
22	31 43	32 49	44	16 69	21 18	64	7 27	10 54
24	29 85	31 41	46	15 57	20 29	66	6 62	9 52
26	28 32	30 36	48	14 53	19 39	68	5 92	8 54
28	26 84	29 31	50	13 55	18 43	70	5 20	7 03
30	25 30	28 26	52	12 63	17 38	72	4 50	6 75
32	24 03	27 23	54	11 71	16 25	74	3 80	5 95
34	22 72	26 19	56	10 72	15 09	76	3 10	5 23
36	21 49	25 16	58	9 68	13 91	78	2 41	4 57
38	20 23	24 13	60	8 72	12 74	80	1 72	3 93
40	19 07	23 10						

Special Influences tending to Shorten Life.

When an individual who propose to assure is found to be subject to a special influence tending to shorten life, an assurance company may either refuse altogether to undertake the risk or may agree to assure the life, charging an enhanced rate of premium or 'loading' as a compensation for the individual's diminished expectation. This enhanced rate may be charged in one or other of the following ways—

1. According to a special table of rates fixed by the company for individuals subject to a particular influence, e.g. residence in a tropical climate.

2. The ordinary premium rate for an individual whose expectation of life is normal may be charged, plus a special additional rate, calculated either as a percentage on the sum assured or on the ordinary premium. This is the method commonly adopted when the influence reducing expectation is the individual's occupation.

3. By adding a certain number of years to the assured's age, and charging him, instead of the ordinary rate corresponding to his actual age, the ordinary rate for an individual so many years older. This is the plan generally followed when the influence reducing expectation is the existence of disease or of a predisposition to disease. It should be noted that when this

method is adopted the number of years to be added to the age must always be greater than the number of years by which it is estimated that the individual's expectation is reduced. A little consideration will show that, where normal formula is applicable, the addition must, in round numbers, be one and a half times the reduction of expectation, i.e. just so many years as will raise the assured's actual age to the age at which the reduced expectation exists.¹

The special influences tending to shorten life may conveniently be considered under three heads, viz.: (1) External, (2) Hereditary; and (3) Acquired, personal influences.

1. External Influences.

The chief external influences likely to reduce expectation of life are (1) locality of residence and (2) occupation

equatorial Africa is considered to belong to the first class, and companies will only assure lives resident there by special agreement and at a special rate. India and tropical countries generally are looked on as belonging to the second class. During time of residence in a locality of this second class, some companies charge, in addition to the ordinary

exceed the corresponding ordinary or English rates, ranges from $\frac{1}{2}$ to $2\frac{1}{2}$

may be more unhealthy than others. For example, are more unhealthy than well drained ones, and in England towns are, as a rule, less healthy than country districts. Thus Guy gives the expectation of life at thirty, for the whole of England, as 34.1 years. The records of expectation of life in towns are generally lower than in the country. For example, in London the expectation of life at thirty is only 31.5 years, while in the country it is 35.5 years. This is due to the fact that towns are generally more unhealthy than others.

2. Occupation.—The occupation of an individual may tend to reduce his expectation of life by exposing him to risk

¹ For more precise calculations a table of expectation of life must be employed thus: Find the expectation corresponding to the individual's actual age, from this deduct the number of years by which it is estimated his expectation has become reduced, then find in the table the age corresponding to the reduced expectation, the difference between this and the actual age is of course the number of years to be added.

² Guy, quoted by Sieveking, *Manual Adviser in Life Insurance*, p. 113.

of (1) mechanical injury, (2) absorption of poison, or (3) contraction of disease, or of a habit, tending to shorten life. For mortality in different trades see Appendix XIII.

1 **Mechanical injury.**—The chief occupations exposing to this risk are as follows military and naval service. In war times extra rates of five to twenty guineas per cent have been charged to officers actually engaged. During time of peace officers of the navy are usually charged an extra rate of half a guinea per cent within certain limits, and a special higher rate beyond.¹ In India an extra charge of about 1½ per cent. per annum (which covers war risk in India) is usually made for military employ, engine-drivers, sailors, and miners. The usual extra charge for these occupations is 1 to 2 per cent. additional on the sum assured. Other

2 **Absorption of poison.** involve this risk.

3. **Contraction of disease, or of a habit tending to shorten life.**—Occupations exposing to risks of this kind are (a¹) very dusty occupations, as grinders, millers, masons, and coal-miners; Sieveking remarks that few of the Sheffield steel grinders attain the age of thirty-five; (b¹) sedentary occupations, especially if carried on in badly ventilated rooms; (c¹) occupations likely to lead to the acquirement of habits of intemperance, e.g.

2. Hereditary Influences.

1. The influence of the offspring on the parents of cases in which

is variously stated by different authorities. Much of this variation arises from difference in the fact accepted as showing hereditary transmission. Thus, if the only fact accepted as indicating this is affection of the parents, a lower percentage,

¹ Sieveking on *est.* p. 221

¹ On *est.* p. 62.

of heredity will be found than when affection of the grandparents or any of their children is accepted. The following are the chief hereditary diseases, and the main facts derived from under consideration as regards India.

1. **Tubercle of the lung.**—The percentage of heredity of this disease is variously stated at 25 to 60 per cent. Females appear to be somewhat more liable to inherit it than males, and the disease seems to be more liable to descend from mother than from father to child. Sieveking considers that where the personal condition of the individual is good, the

2. **Gout.**—Percentage of heredity equals about 50. Sieveking states that the usual practice is to add three years to the age for hereditary liability to gout, but considers this addition inadequate.

3. **Cancer.**—Percentage of heredity, 8 to 33. Twice as many females as males die from this disease; hence the addition to age for hereditary liability to cancer should be greater in the case of females, as cancer is mainly a disease of later life.

4. **Rheumatism.**—Percentage of heredity, about 30. Acute rheumatism, although not so likely to prove directly fatal as other hereditary disease, may damage the heart and so impair expectation.

transmission, and frequently brain disease in one form in the parents is transmitted in another form to the children

6. **Syphilis and scrofula.**—Hereditary transmission of these diseases is chiefly liable to affect the expectation of life of an adult indirectly, *e.g.* by rendering him less able to resist an attack of serious disease.

Heredity to long life.—Limited family vitality requires a substantial increase of premium

The importance of heredity used to be exaggerated, says Sir William Gardner, but the tendency now was too much the other way, partly in consequence of the discovery of the tubercular bacillus and the difficulty of reconciling that with the doctrine of heredity. It was the fashion nowadays to regard heredity as a misapprehension or a superstition. After all had been done, however, it could not be denied that the simple fact of long life or short life was in many cases a hereditary fact. Looking back over three or four or five generations in families known to be long-lived, you will see if many of the members had not even approached being centenarians. The opposite peculiarity was equally notable in short-lived families. Then there are the cases of families, among the members of which tubercular disease was rampant, and not only tubercular disease, but tubercular disease which killed at a particular age or within particular limits.

Indirect hereditary influences.—Great disparity of age (and, according to some, near consanguinity) between the parents, or extreme youth of the mother, may exert an indirect injurious effect on an individual's expectation of life by interfering with his development or power of resisting attacks of disease. Under the head of indirect hereditary influence the influence of sex on expectation may also be considered.

The general expectation of life among females is slightly greater than among males. Females, however, are subject to the special risk attendant on child-bearing. The risk does not attach to the pregnant condition, but to parturition, and attaches specially to a first delivery. Dr. Allen's statistics, collected from various sources, give as the proportion of deaths (from puerperal causes) to deliveries one in sixty-two for primiparæ and one in one hundred and twenty-four for multiparæ. Females, therefore, pregnant for the first time, Sieveking advises,¹ should be charged a special rate, and it is a question whether an extra rate should not also be charged to multiparæ. Such extra rates may be remitted when parturition has taken place or the period of child-bearing has come to an end. Frequent previous miscarriages often indicate a syphilitic taint, and justify an extra rate being charged, no matter what may be their alleged cause. Hereditary tendency to apoplexy, cancer or other diseases usually coming on late in life, may be dealt with by declining a whole-term policy and granting at ordinary rates an endowment policy payable at death or the age of 55, 60 or such age as will reduce the risk.

3. Acquired Personal Influences.

1. A previous attack of disease may be deemed to have reduced expectation. If the disease is (1) serious in nature and likely to recur, *e.g.* cancer, apoplexy, epilepsy, gout, etc.; or (2) likely to have impaired the functions of some important organ, *e.g.* sunstroke, acute rheumatism, dysentery, etc.; or (3) one indicating serious constitutional taint or impairment of function, *e.g.* fistula, piles,² etc.

In some cases the expectation may be deemed to be so greatly reduced as to render the life uninsurable. In other cases the reduction of expectation may be met by an addition to the age. No general rules can be laid down applicable to all cases as to the course which should be followed.

tion for an attack of gout too little.¹

2. Acquirement of a particular habit.—The habit reducing expectation, most commonly coming under notice, is intemperance. Intemperate habits, according to Mr. Neison, reduce expectation so greatly as to bring it down (in the middle ages of life) to about $19\frac{1}{2}$ minus one-fifth of the age, *e.g.* at thirty to $19\frac{1}{2}$ minus six, or $13\frac{1}{2}$ years. Abuse of narcotics other than alcohol, *e.g.* opium,² and habits other than over-indulgence in narcotics may also reduce expectation

3. Existence of a morbid or abnormal condition such as—

(1) **Blindness.**—Usually met by an addition of ten years to the age

exposed the individual to increased risk of accident (6) **Loss of teeth.**—
(7) **Presence of disease.**

Finally, it should be remembered that in the same case there may exist a combination of influences reducing expectation. The locality of residence, occupation, or habits of an individual may, for example, have the effect of augmenting the damage caused to his expectation of life by disease or a tendency thereto. Thus residence in a tropical climate may augment the damage to expectation resulting from certain diseases of the digestive organs. An occupation involving much exertion may augment the damage due to certain affections of the circulatory system, or one involving much anxiety of mind, the damage due to a tendency to brain disease. Intemperate habits again increase the damage due to disease generally, and especially the damage resulting from affections of the nervous and digestive organs. For the detailed examination for these defects see below

¹ C Muirhead, *causes of death amongst Scottish Widows Fund*, A D Socy, 1892

² *Op cit.*, 11 p 71, 113.

Examination of Applicant.

HOW THE EXISTENCE OF INFLUENCE TENDING TO SHORTEN LIFE IS ASCERTAINED.

The usual method is as follows: The individual proposing to assure is—(1) Supplied by the insurance company with a series of printed questions, to which written answers are required (2) Required to refer to two or more persons personally acquainted with him (one being his usual medical attendant), and to these *referees* of the proposed assured a similar series of questions are addressed. (3) Examined by a medical man acting on behalf of the company, who also is usually supplied with a series of questions to be put to the proposed assured; and (4) required to sign a formal declaration to the effect that his statements are true, and are to be taken as forming the basis of his contract with the assurance company.

Printed questions.—The object of the questions put to the proposed assured is, of course, to ascertain whether or not he is subject to any hereditary or other influence tending to shorten life, and being put in a categorical and formal way, delicate questions, such as to previous syphilis, can be asked as a matter of course. In answering them and generally the assured is bound to exercise the utmost good faith in the representations he makes to the assurers; failure in this respect on his part will, as a general rule, render the policy void. Further, save in very exceptional cases, misrepresentation or concealment of material facts will render the policy void. Hence arises a fourth question in regard to life assurance, which presently must be considered, namely: Has there been misrepresentation or concealment of material facts?

Referees.—Any person the assured nominates as one of his 'referees' may refuse to act in such capacity; but if he undertakes the duty, he is bound, like the assured, to exercise the utmost good faith in discharging it, at the risk, should he fail in doing so, of rendering himself liable to an action should loss ensue. Hence 'the usual medical attendant' of the proposed assured, if he accepts the duty of a referee, is bound to answer truly all questions put to him, and to disclose every material fact known to him; or, should he have no knowledge as to any particular fact, in regard to which information is required from him, to state so distinctly.

Medical examination.—The examination of the proposed assured should be thorough, and, in order that nothing may be

omitted, should be conducted in regular order, somewhat as follows :

MEDICAL EXAMINATION OF THE PROPOSED ASSUREE

General external examination.—This may (a) directly or (b) indirectly disclose the existence of a condition tending to shorten life. The chief conditions coming under head (a) are blindness, hernia, loss of a limb, or malformation interfering with the power of locomotion, open ulcers, and deafness.

(1) **Gait, manner, and general appearance.**—This may indicate actual disease of the nerve centres, or of a tendency thereto; or premature decay, the individual looking older than his age; or existence of a habit tending to shorten life, *eg* intemperance. (2) **Skin disease:** a disease of this class may indicate a constitutional taint of intemperate habits. (3) **Weight:** this should be in fair correspondence with the height. From the table on p 45, it will be seen that roughly a male European, 5 feet 7 inches in height, should weigh about 150 lbs., and 5 lbs more or less for every inch above or below this height. The proportion borne by the weight to the height appears, in the case of natives of India, to be as a rule lower than among Europeans. Very low or very high weight in proportion to the height, or marked recent gain or loss in weight, should be looked on with suspicion. A variation in weight of more than 20 per cent. from the standard is regarded by most authorities as incompatible with normal health. (4) **Vaccination.**—The unvaccinated or the unprotected by a previous attack of small-pox are considered unsound, and are not accepted at all by several offices, or, if accepted, death from smallpox and its sequelæ are excluded from the contract, or an extra premium exacted.

In England the percentage of deaths from diseases of the chief systems to total deaths, is about as follows: respiratory, 30 (one-third of these from phthisis); nervous, 13; circulatory, nearly 7; digestive, about 51; and genito-urinary, about 2 per cent.

In India a very large proportion of the total deaths (in the Bombay Presidency about 65 per cent) are attributed to 'fever.' In ordinary years, 'bowel complaints' come next, being credited with (in Bombay) about 8½ per cent of the total deaths. In exceptional years, the deaths from cholera exceed those from bowel-complaints. Thus, in 1877 (the famine year), in Madras, 22 per cent., and, in Bombay, 9 per cent. of the total deaths were reported as from cholera.

The various systems of the body should next be examined.

¹ The total death-rate in Madras in 1877 was 53·2 per 1000.

Respiratory system.—Respiration should be quiet and easy, its ratio to the pulse 1 to 4 or 5, and not quicker than 20 per minute. The chest should expand in all directions, and there should—especially below the clavicles—be no flattening. Deep inspiration should cause no distress. There should be no lividity of the lips, or tips of the ears or fingers; and the individual ought to be able to count aloud rather slowly 1 to 20 or 30 without taking fresh breath. The circumference of the chest should be in fair correspondence with the height, and in suspicious cases the 'vital capacity' (*i.e.* the volume of air expelled after the deepest possible inspiration by the deepest possible expiration) should be ascertained. The chest should be examined by percussion and auscultation, and special inquiry made as to previous hæmoptysis, cough, loss of weight. A single occurrence of hæmoptysis, Sieveking thinks, should be met by an addition of fifteen years to the age, and the life should be altogether rejected if examination shows decided evidence of the existence of tubercular deposit. Out of 524 deaths from phthisis in the Scottish Widows Assurance Society, Dr. Muirhead found that certainly not more than 35 per cent. exhibited any family predisposition, and this percentage corresponds closely with the 34 per cent. of Dr. Williams and with the 36 per cent. of Dr. Cotton. A family history of phthisis is just as common amongst non-consumptives, and he formulates the statement that "15 per cent. at least of proposers to the Society for assurance, and of those accepted by the Society, will show a record of death by consumption among their parents."¹

Nervous system.—The principal symptoms indicating existence of actual disease of this system are paralysis, want of co-ordinating power, hyperæsthesia, anæsthesia, and certain affections of the special sensos. A tendency to disease of this system, again, may be indicated by repeated attacks of giddiness or headache, or by a general appearance of plethora, accompanied by shortness of the neck. Disease of the spinal cord, a previous attack of apoplexy, or confirmed epilepsy, render the life uninsurable. Previous attacks of other diseases, *e.g.* sunstroke, impair expectation in proportion to the amount of persisting damage. Sexual incapacity in males is an early symptom in many neuroses. Knee-jerk and eye-reflex should always be tested.

Circulatory system.—The pulse should be regular between (in adults sitting) 70 to 85 per minute,² soft, but not too

¹ C. Muirhead, *op cit.*, p. 97, etc.

² Pulse-rate is often increased by nervousness of candidate during examination.

compressible. Change of posture should not make a difference of more than 10 beats per minute. The heart sounds should be normal, and the apex-beat in the fifth intercostal space about $1\frac{1}{2}$ inches below, and the same distance to the right of, the left nipple. If a murmur exists, and there is reason to suppose it to be not due to organic disease, postponement of the assurance should be advised. If due to valvular disease, its intensity affords no indication of the amount of danger. Certain forms of valvular disease damage expectation more than others. Aortic regurgitation is the most serious, from liability to sudden death, whilst aortic stenosis and mitral disease, especially if regurgitant in character, is much less serious. Fatty degeneration of the heart obviously greatly impairs expectation. In the rheumatic class prognosis depends largely, or in considerable degree, on good compensation and absence of recurrence of attacks of rheumatism. Age is also important, as acute rheumatism is more a disease of early life—occupation quiet and habits regular. Aortic regurgitation should be rejected, and also double mitral disease. Generally cardiac diseases should be accepted only on careful consideration and in certain selected cases, otherwise a heavy addition should be made in a case of a would-be insurer exhibiting functional disorder of the heart, produced by excessive tea or

second examination should be obtained in two or three years' time. Tea acts on the acceleration of the heart without clouding the higher cerebral functions, but in very varying degrees in different individuals. The chief symptoms of excessive tea-drinking are found in the heart's action. The cardiac symptoms are (1) increased rapidity, (2) intermittency and irregularity, amounting in extreme cases to delirium cordis; (3) pulse very irregular also, and altered in volume and force, and (4) no pericardial rub, though sounds might be quite arrhythmic. These symptoms are due to tea alone, and would disappear in two or three weeks if the tea-drinking were discontinued. The irregularity is of purely nervous origin, it does not end in organic disease of valves, or affect the heart except possibly in the direction of dilation of the cavities. The tea or coffee habit could be easily given up by most persons. In the case of the tobacco habit, the heart becomes irregular and irritable, but the cardiac complications are removable by stoppage in this case also. There are no interstitial depreciations of the heart as in the case of chronic alcoholism, the effects are transient, and

consists in placing before the individual a number of skeins of wool of various shades of colour, and making him sort them in order according to their colour and shade.

Other Questions.

Other questions which may arise in connection with Life Assurance are:—Has there been misrepresentation or concealment of material facts? Has the death of the assured taken place? Did the assured kill himself? What was the cause of the assured's death?

HAS THERE BEEN MISREPRESENTATION OR CONCEALMENT OF MATERIAL FACTS?

This question arises when liability to pay the sum assured is disputed on the ground that the policy is void, owing to such misrepresentation or concealment.

Identification of the proposer.—If the proposer is previously unknown to the medical examiner he must be introduced by some one who vouches for his identity, and identification-marks should be noted.

Concealment of material facts.—A material fact is anything the assurers have a right to be informed of, which may influence the rate of premium, irrespective of whether the party from whom the information is required does or does not know it may have this influence, and irrespective of whether the fact is or is not a condition of things which has actually shortened the life of the assured.

The question whether a given fact is material or not may be one on which expert evidence is not required, *eg* previous rejection of the life by another assurance office. Frequently, however, the fact alleged to be material is the existence at the time of effecting the assurance of a particular habit or disease, or previous attack of disease. Here the question whether the fact is material or not may depend on whether or no such habit or disease is one which usually tends to shorten life, and when this is the case, the opinion of a medical expert may be required in order to enable the Court to decide the question at issue. The existence of disease, or of a previous attack of disease, may or may not be a material fact—It is a material fact if information regarding its existence has been specifically required by the assurers.¹ For cases of concealment of facts see Appendix.

On this point it has been decided ¹ that when the question is one of material concealment in life assurance, only such diseases come within this description as are of a serious nature, and the usual course of which is to shorten the duration of life. The existence of a habit such as usually tends to shorten the duration of life is obviously a material fact. Commonly there is no difficulty in answering the general question whether or no a particular habit comes within this description. In one important case, however,² the expert witnesses called at the trial differed greatly in opinion on the question whether or no opium-eating was a habit tending to shorten life. The same question has arisen in regard to vegetarianism, and it is possible that it might also arise in regard to tobacco smoking.* Where, however, the habit is one which, like the two last mentioned, is not usually held to shorten life, the question whether its existence is a material fact or not, has been held to depend on whether or no specific inquiry as to its existence has been made by the assurers. Considerable difficulty is sometimes met with in coming to a conclusion as to whether or no a particular habit existed at the time the assurance was effected. In the case, for example, of alleged intemperate habits, it is difficult to draw a line between moderate use and abuse of alcohol; and often difficult, therefore, to come to a conclusion as to whether what existed at the time of effecting the assurance was the latter or the former. When, however, this is the question at issue, the decision in the case usually rests on the ordinary evidence produced, not on the expert evidence.

To establish that there has been misrepresentation or concealment, the existence at the time of effecting the assurance, of the fact alleged to have been misrepresented or concealed must be proved. This, in many cases, is a matter of ordinary, not expert, evidence. In other cases proof of the existence of the fact concealed rests in whole or in part on expert evidence; *e.g.* the assured may have endeavoured to conceal a previous attack of disease, by concealing the name of his usual medical attendant. Such cases usually present no difficulty. Cases more

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of the symptoms and usual course of the disease alleged to have existed.

HAS THE DEATH OF THE ASSURED REALLY HAPPENED ?

This question may in effect be one of identity, namely, Is this body that of the assured ? or, in cases where no direct proof of death is obtainable, one of presumption of death. These two subjects have already been considered (see pp. 74, etc.). This question also arises occasionally in cases where, with the view of defrauding an insurance company, an assured disappears, having first fabricated evidence of his own death.

DID THE ASSURED KILL HIMSELF ?

Assurance policies almost always contain a clause exempting the company from liability should the assured "die by his own hands" or "commit suicide," or die by the hands of justice. In giving evidence at an inquest, therefore, it should be kept in mind that an opinion as to the cause of death, given at such inquest, may afterwards be called in question in an action to recover assurance money. In such a case, omission to make a thorough examination of the body may place the witness in a very awkward position. Again, a question, which has more than once arisen in the course of actions of this kind, is this : The assured kills himself during an attack of insanity, is this "death by his own hands" or "suicide," as the case may be, according to the phrase used in the policy ? On this question the English judges have expressed different opinions. It has, however, been decided by a majority of the judges that these phrases, as used in assurance policies, include all cases of intentional self-killing, no matter whether the individual be or be not insane at the time. Though assurance policies sometimes contain a clause repudiating liability should the assured die by his own hand, in actual practice almost all offices pay unless there has been fraud. Many insert a clause repudiating liability in case of suicide within a short period, usually one or two years.

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FACTS

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not have been due to the disease in question; and (2) cases where the inference that a particular disease tending to shorten

life existed at the time of effecting the assurance, rests on the rapidly fatal termination of the case from such disease. No

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WHAT WAS THE CAUSE OF THE ASSURED'S DEATH?

Obviously, when it is alleged that the assured killed himself, this question directly arises. So, also, this question may arise indirectly, in a case where it is alleged that there has been material concealment, seeing that the cause of death may afford corroborative evidence of the fact that there was such concealment. Further, the question, What was the cause of the assured's death? may arise in the following cases.

Accident Assurance and other Compensation Claims for Accidental Injuries.

The legal definition of an 'accident' with reference to compensation of claims was established by Lord Macnaghten's ruling in 1903 (*Fenton v. Thorley & Co., Ltd.*) as follows: "The expression 'accident' is used in the popular and ordinary sense of the word as denoting an unlooked-for mishap, or an untoward event which is not expected or designed."

Where the life is assured by an insurance policy against accident, the term 'accident' is deliberately restricted by the insurers, and is defined as 'any bodily injury caused by violent, accidental, external, and visible means, and resulting in death or disablement within three months of the accident;' and such restrictions, especially when serious illness or deformity or death follow an accident, although not the probable result of that accident, frequently lead to litigation, though reputable companies usually settle reasonable claims. The following decisions¹ show the extensive range of happenings which have been ruled to come within the meaning of the terms of the insurance policies:—

1859.—Spinal injury from lifting weights: *Martin v. Travellers' Ins. Co.*

1864.—Hernia after fall; necessary operation; death: *Filton v. Accidental Death Ins. Co.*

1891.—Falling under railway engine during sudden illness (a fit): *Lawrence v. Accidental Ins. Co.*

1887.—Paring corns leads to fatal gangrene of leg: *Durham Spring Ass., Cave, J. (Times, Jan. 26).*

1889.—Shoulder dislocated; while lying up was restless; pneumonia contracted; death within a month: *Intt. v. Railway Passengers' Ass. Co.*

¹ Cited by S. B. Atkinson, M.A., B.A., in *Trans. Med. Leg. Soc.*, II. 13, 1904

1893.—Cartilage in knee joint dislocated while stooping. *Hamlyn v. Crown Assurance Co.* (Escher, M.R.). "Unexpected result" Lopes, L.J.
 "Something unforeseen and unexpected and casual".

1896.—Mental shock, without physical impact. *Pugh v. London, Brighton, and S.C. Railway.*

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 septic pneumonia one
 ccident Insurance Co.

On the other hand, the following were held to be not 'accidental'—

1861.—Sunstroke after exposure; death same day. *Sinclair v. Maritime Passengers' Assur. Co.*

1870.—Wound in foot, erysipelas in five days, death on seventh day from injury. *Smith v. Accident Ins. Co.*

1883.—Fall; dislodgement and impaction of gall-stone, death. *Cawley v. National Employers' Accid. Assur. Assocn.*

1899.—Poison swallowed, mistaken for medicine, death (policy excluded such cases). *Cole v. Accident Insur Co.*

1889 (Sc.)—Thrown from carriage, Bright's disease aggravated, death. *McKeechnie's Trustees v. Scottish Accident Co.*

1892 (Sc.)—Prolapse of hepatic flexure of colon in pulling on stock, fatal obstruction of bowel. *Clulero v. Scottish Accid. Co.*

1896 (Sc.)—Germ infection from undisclosed source. *St. Clair Gray v. Northern Accid Ins Co.*

1904.—Syncope after ejecting a drunken man. *Scarr v. General Accident Assur. Co.* See Prof. Powell's Notes in App. XI

For non-fatal accidents, the foregoing lists supply useful indications as to the validity of compensation claims, and it has been ruled that even a predisposing infirmity may not vitiate the 'accident,' thus in 1900, hernia recurring in lifting frozen planks was held to be an 'accident' for workmen's compensation (*Timmings v. Leeds Forge Co.*). Mental shock, also, has been compensated, as opposed to the more direct nervous shock of an accident.

The insurance company, except by a previous special agreement, has no power to demand a necropsy upon the body of the assured (*Ballantine v. Employers Ass. Co.*, 1893), nor can it claim to be represented at a personal medical examination, nor during a necessary surgical operation (Home Office direction in *Ill. Law Times*, 296). The insurance companies often take a liberal view of the circumstances, thus in the case of a man murdered by a burglar, his death was treated as accidental.

In fatal cases the question takes the form—Was death due to accident or to natural causes?—the assurers being liable in the former case, but not in the latter. When the cause of death has been definitely ascertained, there is usually no difficulty in coming to a conclusion on this point; and as may be seen from the above list death from sunstroke does not come

within the meaning of death from accident, as used in such policies. So, also, there is usually no difficulty when death occurs within a short time after the alleged accident. Where, however, a considerable interval of time has elapsed between the accident and death, difficulty may be experienced in coming to a decision on the question. In such a case points for consideration are: (1) Were the symptoms and *post mortem* appearances present in the case, such as indicate the presence of disease? (2) Could such disease have arisen from the accident? (3) What influence would the accident be likely to exert on such disease? &c., &c.

MEDICAL OBLIGATIONS.

CHAPTER XXI.

MEDICAL RESPONSIBILITY, PATIENTS' SECRETS, AND MALPRAXIS.

"All physicians and surgeons acting unskilfully in their several professions must pay for injury to brute animals the lowest, but for injury to human creatures the middle amercement (500 panas)."—MANU, transl. by Jones, IX. 284

Obligation of secrecy.—The ethical law of professional secrecy and honour continues to be much the same to-day as it was in the fifth century B.C. in the time of Hippocrates, the 'Father of Medicine,' whose famous 'Oath'¹ was the parent of the 'declaration' which is still incumbent upon medical graduates of our universities, and upon licentiates and diplomates of most of the colleges.² The legal obligations, however, and the

operators of that art. "Whatever house I am called upon to attend, I will aim at making the patients' good my chief aim, avoiding all injury, corruption and unchastity, and whatever I hear in the course of my practice relating to the affairs of life of my patients that ought to remain secret, nobody shall ever know of me. May I be prosperous, honoured and esteemed by all men as I observe this solemn oath, and may the reverse be my lot if I violate it and forswear myself."

¹ Each medical graduate in the Scottish Universities must take this declaration. "I do solemnly and sincerely declare that as a graduate in medicine in the University of ———, I will keep silence as to anything I have seen or heard while visiting the sick which it would be improper to divulge."

modern craving for publicity, which, among other things, obtains the issue of bulletins signed by the medical attendants, with details of the illnesses of persons of position, have caused the old ethical code to undergo considerable alterations. As a result, the medical man in daily practice has to publicly give away the secrets with which he has been entrusted, or suffer a legal penalty for not doing so. Thus when subpoenaed, and when giving evidence on oath, nothing can be concealed, unless self-incriminating, of which he has knowledge through his attendance on his patients. Insurance companies also require from him the fullest details of the family medical history of patients desiring to be insured, and to divulge matters which might be detrimental to his patient's chance of insurance. The State also obliges him in certain cases of infectious disease and sudden death to notify forthwith to a local authority, comprised of laymen, his opinion that such diseases are in existence, and were he to attempt to conceal such facts, he would incur a penalty, and be treated as a misdemeanant, notwithstanding that such notification might be detrimental to his patients. He is compelled to give to the registrar certificates of deaths of his patients, and such documents are not treated by the authorities as confidential, but copies can be obtained by any one from the registrar on paying a small sum.¹

Nevertheless, it has been ruled that "secrecy is an essential condition of the contract between a medical man and his employers, and breach of secrecy affords a relevant ground for an action of damages (*A.B. v. C.D.*, 14 Dunlop, 2nd S, 177). It is therefore well always to adhere to the rule of inviolate secrecy as far as possible, and never to reveal anything, even the most trivial matters, without the patient's express consent; and so afford no ground for an action for damages for libel or otherwise. Where, however, the divulging of the secret is necessary to protect an innocent person from grave injury in a private or civil case, the conditions are different. On the other hand, the ruling of Lord Mansfield (see p. 16) has been set aside by so experienced a criminal judge as Sir Henry
and a case,
justified in
(*Kilson v.*

Playfair—*Brit. Med. Jour.*, 1896, 799). Acting on this later ruling, the demand of the Court to divulge a professional secret was successfully resisted by a practitioner, a graduate of a Scottish University who had made the "Scottish" form of declaration (see p. 425).

¹ A. G. Bateman, M.B., *Trans. Med. Leg. Soc.*, II. 50, etc., 1904.

Case.—Alleged Adultery.—At Notts Bench of Justices, in 1900, this action was laid by a husband against his wife, who was living apart from him by deed of separation, for nullification of maintenance order on the ground of alleged adultery. The wife defended the action, and

given as to the power of magistrates to compel answers to questions of professional secrecy in a civil court. The Bench, after deliberation,

Even when the police surgeon or civil surgeon has to *examine a prisoner* for evidence of the crime on his or her person, he should first warn the prisoner that anything found would have to be reported by him whether in favour or against, and that he or she was *legally entitled to refuse permission to be examined*. In the examination of women the surgeon must be especially careful, as already quoted at p. 289. An assault has sometimes been alleged against the surgeon for his examining, at the instance of the police or others, a female alleged to be pregnant or the victim of rape. In such cases the consent of the party must invariably be first obtained by the surgeon in the presence of witnesses, whose names should be duly recorded in noting this fact in the report, and the examination itself should be made in presence of these witnesses. Moreover, the surgeon should not himself undress the female (see p. 290).

If a medical man unnecessarily strip a female patient naked under the plea that he cannot otherwise judge of her illness, it is an assault if he himself takes off her clothes (*R v. Rosinski, 13 Mod, C. C. 12*).

In the case of a child, the obligation to notify certain **infectious diseases and sudden deaths** under suspicious circumstances, is an important part of a practitioner's responsibility. In cases of *infanticide*, only a 'common misdemeanor' of course, attend to the patient's care, but no legal obligation rests upon the practitioner to report to the authorities, as the attempt to commit suicide is by statute declared to be a misdemeanor, and not a felony. If, however, the patient dies, he should acquaint the coroner, or request the friends to do so. In regard to the crime of attempted abortion it seems generally agreed that it is inexpedient for a medical man to go out of his way to give information to the police that a patient of his to whom he was

called had been trying to procure her own abortion; but it is quite different when he ascertains that she has had the aid of a professional abortionist. But in all cases in telling such secrets as compelled by law to do, he should be careful to tell only the proper authority, and mark all letters containing such information 'private and confidential.'

Obligation of skill.—**Malpraxis** is the want of reasonable skill and care on the part of the medical attendant, whereby the person under treatment limb. The 'skill' demands specially expert kind, but is expected from an ordinary d best. Thus a practitioner who prescribed morphine for asthma, whereby his patient acquired the morphine habit, was said to have exercised 'reasonable' skill. Another practitioner who kept a Colles' fracture in a splint for several weeks, whereby adhesions of the extensor tendons occurred, was also said to have exercised 'reasonable' skill.

Case—**Ordinary not eminent skill to be expected** (*Gibbs v. Tunaley*).—It was ruled that the jury were not to expect the same amount of

elsewhere, the person who caused the wound, and not the medical man, would be held responsible for the death.—*Norfolk Lent Assizes, 1846.*

In the treatment of a case of criminal wounding the position of the surgeon in charge of the case is one of great responsibility, for if the wounded person dies, the surgeon may be blamed for his treatment. It may be alleged by the defence, on the one hand, that any operation the surgeon may have done contributed to or caused the fatal result, or, on the other hand, that the death would not have occurred if a certain operation had been performed. A similar question may also arise with reference to medical treatment and nursing. What the law requires of a medical man in the treatment of a case is only that he will exhibit 'reasonable skill and care.' An operation in a criminal

course is not possible, as in isolated country towns, the surgeon

should use his utmost skill, and this is all that the law requires of him.

Deaths under chloroform, or other anæsthetic administered for the purpose of performing an operation, would be judged of in the same way, namely, 'was the anæsthetic necessary,' and was it administered with reasonable skill and care?'

In every case where an operation is performed, the consent of the patient, or of his guardian if a minor or unconscious, must first be obtained.

In fractures and dislocations, it is well to use the X-rays to prove that fixation and reduction have been accomplished, or if not, the surgeon should have written proof that he suggested its employment to the patient, and was refused its aid. The skiagraph, however, can never form the basis upon which the amount of damages is assessed. That will depend, as formerly, upon the functional disability and loss which the patient has sustained. Whenever a skiagraph is introduced as evidence, the defendant should demand the privilege of having a similar examination made, and should employ expert testimony to fully explain its meaning to the jury.¹

The treatment followed should be of the recognized or established kind, and no new form of treatment of the nature of an experiment should be practised without the consent of the patient or guardian.

The 'care' should be of such actively attentive kind as never to give reasonable excuse for a charge of neglect or carelessness. Cases have occurred of syphilis and puerperal fever having been conveyed by a surgeon through carelessness.

Responsibility of hospital authorities to patients.—A patient who has sustained injuries in the course of an operation performed upon him may sue the presiding surgeon for damages and not the hospital authorities, also, it would seem, the medical student, nurse, or other attendant who in obeying the surgeon's directions assisted in inflicting the injuries may be sued

... (Case—Hallyer v. St. Bartholomew's Hospital [1909, 2 K. B. 820] —

of both arms. The examination was undertaken gratuitously. The hospital authorities were held not to be liable for negligence when the nurses and other servants were acting under the orders of the surgical and medical staff.

¹ Dr. Leonard in *Medical News*, February 25, 1901.

Continuance of attendance.—Even in ordinary civil practice it is necessary for the practitioner at times to protect himself against possible charges of neglect made by an unreasonable patient or his friends, when the surgeon has been called in casually to see the case, and has not been definitely asked to continue to attend it. It is well, therefore, in such instances, to take the precaution of getting such people to record definitely in writing whether they desire him to attend the case or not. Once he undertakes to attend the case, he is bound to continue his visits as long and as frequently as the requirements of the case may demand, and he is held to determine when his visits may safely be discontinued, though he is always at liberty to discontinue his attendance at any time by giving reasonable notice of his intention to do so.

PART II.

POISONING OR TOXICOLOGY.

CHAPTER XXII.

POISONS IN THEIR GENERAL ASPECTS.

POISONING, with its secret treachery, has from early times been especially ascribed to the East as the favourite means employed by assassins to remove objectionable persons and take life, and certainly at the present day poisoning is very much more common in India and the East than in Europe.

Poisons were doubtless early discovered by primitive man, who by experience or accident must soon have learned to avoid them himself and to use them against his enemies or game, for nearly all savage tribes use poisoned arrows. Indeed, the classic term 'Toxicology' is derived from the Greek word for 'an arrow or missile for the bow,' which would indicate that the earlier use of poison in Eastern Europe was to smear over arrows for slaying. The modern word 'poison' comes from the Latin *poto*, to drink, as signifying the more modern mode of administering a poison, namely, as a 'potion' or draught. The Indian term *Bish* is from the Sanskrit root 'to permeate or pervade' and denotes the intruding, alien and diffusive nature of poison. The ancient Indian scriptures contain references to the poisoning of kings, the doings of professional poisoners and of widespread organized poisoning in almost prehistoric times. In one of the *Shastras* translated by Dr. Wise¹ it is written "It is necessary for the practitioner to have a knowledge of the symptoms of the different poisons and their antidotes, as the enemies of the king had women and ungrateful servants, mix poison with food." Susruta, the Indian Hippocrates, describes the several modes of poisoning in ancient India, how the

¹ Medicine of the Hindus.

poisons are mixed with food or drink, honey, medicine, bathing water, anointing oils, perfumes, eyelash pigments, snuff; or sprinkled over clothes, beds, couches, shoes, garlands and jewellery, saddles of horses, etc.; how poisonous draughts are prescribed as love-charms, also the secret poisoning of wells and other drinking-water to destroy enemies.

The Mahābhārat, which is usually ascribed to the 5th or 6th century B.C., mentions that Bhīm Sen, the Hindu Samson, was poisoned by his cousin Durjodhan in revenge for being defeated by him in a duel. In a semi-historical legend of mid-India¹ it is related that the grandfather of Asoka, Chandra Gupta, a contemporary of Alexander the Great, sent to the latter monarch in the guise of a present, a fascinating girl who was a 'poison-maiden' fed on poison until she was so saturated with venom that her embrace would prove fatal to an ordinary mortal—the mere conception of the idea of such a Borgia-like siren would imply considerable familiarity with poisoning.

Strabo relates that the custom of burning Hindu widows alive on the death of their husbands (*sati*) was introduced as a check against the prevailing custom of Hindu wives poisoning their husbands, so that the wives would thus have an interest in not being privy to the premature death of their lords.

In Mohammedan times, poisoning was a recognized form of capital punishment, and was unusually rife in harem intrigues and against political foes and prisoners.

Many Indians consider the taking of life by bloodshed a greater crime than poisoning, strangling, etc. Note the use of the word "Khun," literally "blood," as a synonym for "murder." A medical witness may be puzzled by the persistence with which an Indian jurymen will cross-examine to know if there was any blood spilled on the clothes, etc. If no blood is shed, in their opinion, the manslaughter does not amount to murder, and the punishment should be less.

For magical and mystic purposes without intent to actually kill a good deal of what may be called 'accidental' poisoning goes on in the country districts, see pp. 29 *et seq.*

This is mostly practised here, as elsewhere, by jealous women or desperate lovers of either sex for the purpose of captivating affection or of infatuating and enthralling the object of desire. But it is also used for baneful purposes to cause disease, death, or some strange aberration; and whether employed by love or by hate it has certainly always been intimately connected with some real knowledge of medicine and has veiled a great deal of downright poisoning.²

¹ *Mudra-rakshasa* in Wilson's *Hindu Theatre*. ² Chevers, *Med. Jur.*, p. 105.

Definition.—It is not easy to define the term 'poison.' It is not enough to define it as 'any substance which on being absorbed into the body injures health or destroys life.' Because (1) certain substances harmless in small doses are capable of causing death when absorbed into the system in large doses although not usually considered poisons, *e.g.* common salt and *as*; (2) the *re* not cou- (3) certain substances may cause injury or death by local action without absorption into the system, *e.g.* corrosive acids and mechanical irritants. The definition, therefore, should include, in addition to 'any substance absorbed into the body,' also, 'any substance which by chemical action on the tissues injures health or destroys life.'

For legal purposes in India, however, the exact definition of a 'poison' is not essential, because the law usually paraphrases in explanatory form its reference to 'poison.' Thus, in the causing of 'hurt' and 'grievous hurt' by poison, *ss.* 324 and 326, *I.P.C.*, state: "Any poison or any corrosive substance," or "any substance which it is deleterious to the human body to inhale, to swallow, or to take into the blood." Hence, for conviction under these sections, it is not necessary to establish that the substance by means of which the hurt or grievous hurt was caused is a poison; it is sufficient if it be proved that it is a substance which comes under the above-stated description. Again, *s.* 299 declares: "Whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death or with the knowledge that he is likely by such act to cause death, commits the offence of homicide." Hence, if A administers a substance to B, with such intent or knowledge, and thereby cause B's death, A may be convicted under this section of the offence of committing culpable homicide, irrespective of whether the substance administered may or may not strictly be called a poison. For it is the *intent* which suffices to constitute a crime, irrespective of the dose or even the nature of the substance. In *s.* 328 is: "Whoever administers to, or causes to be taken by, any person, any poison or any stupefying, intoxicating, or unwholesome drug or other thing, with intent to cause hurt to such person, or with intent to commit, or to facilitate the commission of an offence, or knowing it to be likely that he will thereby cause hurt, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine." Here, again, it will be observed that the addition of the words "any stupefying, intoxicating,

or unwholesome drug or other thing," render the exact definition of the term 'a poison' unnecessary for the purposes of this section. It should, however, be noted that the words "or other thing" must be read "other unwholesome thing." Hence, administering a substance as to whose nature no evidence was given, which was intended to act as a charm, was held to be no offence (*R. v. Jotce Ghoratt*, 1 *Suth. Cr.*, 7).¹ The question of a definition of the exact meaning of 'poisonous substance' might arise in the case of a person charged under s. 284 of the *Penal Code* with the offence of "knowingly or negligently" omitting "to take such order with any poisonous substance in his possession as is sufficient to guard against probable danger to human life from such poisonous substance."

Restriction on sale of poisons.—In India, with the exception of Bombay Presidency, there is practically no restriction on the sale of poisons, other than a partial one on white arsenic; and this accounts doubtless in considerable degree for the excessive prevalence of poisoning in India. There was no restriction whatever on the sale of poisons, except in Bombay, notwithstanding the repeated representations by myself and other chemical examiners, up till 1899, when the White Arsenic Act (of 1899) was passed, but regulations as to the possession and sale of the white arsenic are limited to such local areas as local Governments may direct, the result being that arsenic may still be readily obtained in large quantities in an ordinary hania's shop in most bazaars, with practically no restrictions. On poisons other than arsenic, there is no restriction whatever except in Bombay, which in its Sale of Poisons Act incorporates the provisions of the English Arsenic Act (14 *Vict. cap.* 13).

The Sale of Poisons Act (Bombay Act VIII. of 1866). The chief provisions of this Act are that certain poisons named in Schedule A of the Act (1) may only be sold by licensed vendors (s. 3); (2) (except when dispensed as medicine on the order or prescription of a practitioner of medicine) may only be retailed to persons known to the vendor, or in presence of a witness known to the vendor, and to whom the purchaser is also known; and each sale must be entered with the purchaser's name and address in a book kept for the purpose (ss. 13, 14, and 19); and (3) powdered white arsenic (except in special cases) may only be sold mixed with soot, in the proportion of one ounce to each pound of arsenic, or with indigo or Prussian blue in the proportion of half an ounce to each pound of arsenic (s. 17). Schedule A of the Act enumerates the poisons it applies

¹ *Mayne's Penal Code*, 292.

to, with their vernacular names, as follows "1 Vegetable poisons—Aconite (*botchnag*), cocculus indicus (*lakmari*, *lakphul*), datura (*datura*), henbano (*lhorasanu ajwau*), nux vomica (*kuchla and lajra*), Saint Ignatius' bean (*papita*), and Calabar bean. 2. Mineral poisons.—White arsenic (*phutkya somul*, *somul*), red arsenic or realgar (*mansil*), yellow arsenic or orpiment (*hurlal*), Scheele's green or arsenite of copper, and Schweinfurth green or aceto-arsenite of copper (*khirwa*), and corrosive sublimate (*ruslapur*)" For Bengal, provision has been made to guard against the ignorant compounding of European drugs by unqualified druggists (Beng. Mun. Act, s. 252); but no restriction is placed on the indiscriminate sale of indigenous poisons in the bazaar, which is much the greater evil. What is needed is a Bill for all India somewhat similar to the poison schedule of the English Pharmacy Act (31 & 32 Vict. 21), as is in force in the Bombay Presidency. In Government dispensaries the rules for the custody and dispensing of poisonous drugs prescribe that the labels of poisons be printed on yellow paper with the word 'poison' in English and vernacular affixed to all bottles, and that a copy of the rules, pasted on paper or board, is to be suspended in every apartment where poisons are dispensed.

The need for legal restrictions, even in the large cities, is shown by the following recent case.

Case.—Accidental poisoning through carelessness.—In 1901, a Mr. Hicks, at Calcutta, was taken ill with dysentery, and was advised to take a vegetable compound known as 'Supari-la-phul.' This drug was obtained from the grocery of Ram Nath Dass, but with it was a large quantity of aconite, which is a deadly poison. This was administered unwittingly to Mr. Hicks, who succumbed to the effects. It was impossible to tell from the contents of the stomach what quantity of aconite was actually administered; anyhow, the accused was ordered to be prosecuted on a charge of doing a rash act by omitting to take due care in the sale of a poisonous drug. The accused raised the plea that the sale was actually effected by his assistant, and that he was not responsible for the acts of his servant. The Court held a contrary view; moreover, the accused was found guilty of gross neglect by not exercising due and proper control of the aconite. The accused was convicted under s. 268, *I. P. C.*, and sentenced to three months' rigorous imprisonment.

It is not yet possible to get any precise estimate of the prevalence of poisoning in India as a whole, for no systematic attempt is made to record this information in official statistics. An estimate is only to be formed approximately by piecing together the figures in the various provincial police and sanitary returns with those of the chemical examiners. The police returns only refer to reported cases of criminal poisoning, and the sanitary only to reported fatal cases; and the chemical

examiners' return is simply the record of the results of analyses in the small proportion of cases in which viscera and vomit and other suspected matters are sent for analysis.

For Bengal, the statistics, such as they are, have been collated by Drs. J. F. Evans and C. L. Bose,¹ for comparative purposes, for the two quinquennial periods 1876 to 1880, and 1889 to 1893, with the following results: Murder by poison.—During the five years 1876 to 1880, 94 cases of murder by poison in Bengal were reported by the police, and during the five years 1889 to 1893, 81 cases, or an average of 0·31 and 0·23 per million of the population respectively, as compared with an average of 12 cases in England, 0·07 per million of the population for the years 1876 to 1880, which shows that in Bengal murder by poison is more than four, and over three times respectively the rate for England. In these cases the evidence of murder was usually, if not in all, established by the chemical analysis.

Suicide by poison.—During the five years 1876 to 1880, 11,662 suicides, or 38·8 per million of the population, were reported by the Sanitary Commissioner for Bengal, and during 1889 to 1893, 15,743 or 45·8 per million. As the number of suicides in all England and Wales in the year gives 65·2 per million, the reported suicides in India are less relatively; but there is every reason to believe that a large number are never reported. No returns for Bengal, however, show what proportion of these suicides is due to poisoning. For Calcutta city, however, the statistics are more complete, and these give for the years 1876–80, 126 cases, and for the years 1889–93, 236 cases, or an average of 36·42 and 68·84 per million respectively (registration is more accurate of late years) as against an average of only 3·55 per million in England for the years 1876–80. And of the total cases of suicide in Calcutta 55·8 per cent. were due to poison, as against 12·25 in England, showing that suicide by poison is about nineteen times more prevalent in Calcutta than amongst the general population of England. The conditions of life in a city are likely to make suicide more prevalent than in rural areas. Accidental fatal poisoning.—There are no statistics available for the province, but for the town of Calcutta there were respectively 1·4 and 11 such deaths reported during these two periods, or a rate of 6·5, and 3·6 per million, excluding snake-bite, as compared with 5·15 per million per annum for England during 1876–80. A very large number of such deaths are believed to pass unreported, especially in the practice of ignorant quack native medical

¹ *Trans. Ind. Medl. Congress*, 1894.

practitioners. Non-fatal cases of poisoning.—There are no provincial statistics for these, except for the reported criminal cases by the police. These are mostly cases in which *datura* or other stupefying drugs are given for the purposes of theft. There were 161 such cases in 1889–93 reported, or 0.46 per million of the population. The Calcutta hospitals in 1898 treated 127 non-fatal cases.

The special poisons usually selected for homicide and suicide in India are very few in number, consisting chiefly of arsenic, opium and a few indigenous substances (alkaloids and European poisons are only used in a few cases in cities), and each poison has, by long-established custom, come to be used for a particular class of crime. Thus:—

For homicide	<div> <div> <div>ARSENIC is chiefly used in about half of the cases</div> <div>Aconite comes next</div> <div>Nux vomica</div> <div>Mercury, copper, antimony</div> <div>(Opium for murder of children and drunken persons)</div> </div> <div> <div>OPIMUM chiefly,—about three fifths of total cases in Bengal</div> <div>Arsenic about one-fifth of the cases</div> </div> </div>
For suicide	<div> <div>Datura.</div> <div>Indian hemp.</div> </div>
For stupefying for robbery of fatuity (not necessarily with intent to murder)	<div> <div><i>Plumbago rosea</i></div> <div>Oleander</div> <div><i>Calotropis</i> sp.</div> <div>Colocynth</div> </div>
For abortion	
Accidental	<div> <div>Snake poison, aconite, } in quack</div> <div>mercury, arsenic } medicines</div> </div>

The relative frequency with which particular poisons are used in fatal cases may, to some extent, be estimated from the reports of the chemical examiners on the results of their analysis of human viscera in poisoning cases. The two poisons most frequently used in India to take human life are arsenic and opium. Arsenic is especially used for homicide (and also cattle poison), whilst opium is the special favourite for suicide, occasionally it is used for homicide, in case of young children or drunken persons. The next most frequent poison is datura, used for stupefying people to facilitate robbery. Others less frequently used are:—

Mineral.—(a) Copper.—Cases of poisoning by compounds of this metal sometimes arise accidentally from contamination of food by the copper cooking vessels largely employed in India; occasionally, however, cases of attempt at homicide by the

examiners' return is simply the record of the results of analyses in the small proportion of cases in which viscera and vomit and other suspected matters are sent for analysis.

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¹ *Trans. Ind. Medl. Congress*, 1894.

		<i>Mineral Acids.</i> —Sulphuric, nitric, hydrochloric, fluoric	ives.	Action.	
IRRITANTS .. (chiefly topical)	Mineral ..	phate of potash, barium, etc.	Irritants	Topical.	
		<i>Metallic</i> —Arsenic, antimony, mercury, lead, copper, zinc, iron, chrome tin, silver, bismuth.			
		<i>Non-metallic</i> —Phosphorus, bromine, iodine, chlorine (aniline) and glass			
	Vegetable	<i>Organic Acids</i> —Oxalic, acetic, etc			
		<i>Purgative</i> —Colocynth, madar, aloes, croton, gamboge, hellebore, arum, etc.			
		<i>Abortive</i> —Ergot, savin, plumbago.			
	Animal ..	<i>Nervine</i> —Laburnum, yew, oxalic acid		<i>Nervine</i>	
		<i>Hæmolytic</i> —Abrus, ricinin, saponin		<i>On blood</i>	
		Venomous snakes			
	NECROTICS (chiefly vegetable)	Cerebral ..	Cantharides and arthropod poisons, e.g. centipedes, scorpions, wasps	Narcotic Anæsthetics, Inebriants Delirants	On brain
			Putrid food and fish—ptomaines		
			Trichiniasis and tapeworm (Auto-intoxications)		
		Spinal ..	Opium and morphine		
			Chloroform, chloral, cocaine		
			Alcohol, ether, phenacetin, sulphonal, carbolic acid, creasote, fusel oil, naphtha, benzol, petroleum, nitrobenzol, nitroglycerine, aniline, camphor, and turpentine		
Cerebro-spinal, cardiac, etc		Belladonna, datura, hyoscyamus, Indian hemp, cocculua, indicua, lathyrus, poisonous fungi			
		Strychnine and nux vomica, brucia gelsemium.		<i>On cord.</i>	
		<i>Depressants</i>	Tobacco digitalis, oleander, aconite, colchicum, hydrocyanic acid	<i>On heart</i>	
Peripheral		<i>Asphyxiants</i>	Carbonic acid, carbonic oxide, coal gas, nitrous oxide, sulphuretted and carburetted hydrogen, sewer gases	<i>On lungs</i>	
			Conium, curara, etc	<i>Nerve-endings</i>	

NECROTICA
(chiefly vegetable)

malpraxis, although not met with so often now as formerly, are still occasionally seen. Occasionally also ruskapoor, or calome containing a variable percentage of corrosive sublimate, is criminally employed. (d) Pounded glass.—This is popularly believed in India to be a powerful poison, and is occasionally mixed with food with homicidal intent.

Vegetable.—Next to opium and datura, the vegetable poisons most frequently used for homicidal and suicidal purposes are aconite, oleander (or *nerium odorum* and *cerbera thevetia*), *nux vomica* (and its alkaloid strychnia), and various euphorbias. Of these, aconite and strychnia have also given rise occasionally to accidental cases, notably, the first, from its use as a fortifying agent for alcoholic liquor, and the second, from its use as a dog poison. The seeds of *cerbera thevetia* are sometimes used as a cattle-poison, and the milky juice of the milk bush, and other euphorbias, as an ingredient in irritant preparations employed as local applications, plumbago rosea, and occasionally various cucurbitaceous tubers, are internally administered for the purpose of procuring abortion. Madar (*calotropis procera*) and tobacco are said to be used for purposes of infanticide, and in some parts of India a paste made from the seeds of *abrus precatorius* is used, by subcutaneous insertion, for the purpose of destroying cattle.

Classification of Poisons.

Poisons may be classified according to their action, as on the opposite page.

1. **Irritant poisons**, or such as possess a marked local irritant action, exciting irritation and inflammation; and when swallowed cause vomiting, and, as a rule, also purging. A few of these, when concentrated, act as 'corrosives,' i.e. cause chemical destruction of the tissues. Foreign bodies, i.e. powdered glass, stones of fruits, etc., act in this way.

2. **Neurotic** are poisons such as have a specified action on the nervous system, brain or spinal cord. (1) Cerebral poisons or such as act mainly on the brain, causing delirium or narcotism; and tending to death by coma. (2) Spinal poisons or such as act chiefly on the spinal system, causing either tetanic spasm, or local anaesthesia or hyperaesthesia, or paralysis.

IRRITANTS .. (chiefly topical)	Mineral	<i>Mineral Acids</i> —Sulphuric, nitric, hydrochloric, fluoric (carbolic)		Corrosives.	Action.	
		<i>Alkalies and Carbonates</i> .—Potash, soda, and ammonia.				
		<i>Alkaline Salts</i> .—Nitrate and sulphate of potash, barium, etc				
		<i>Metallic</i> —Arsenic, antimony, mercury, lead, copper, zinc, iron, chrome tin, silver, bismuth.				
		<i>Non-metallic</i> —Phosphorus, bromine, iodine, chlorine (aniline) and glass				
	Vegetable	<i>Organic Acids</i> —Oxalic, acetic, etc		Irritants	Topical.	
		<i>Purgative</i> —Colocynth, madar, aloes, croton, gamboge, hellebore, arum, etc.				
	NECROTICS (chiefly vegetable)	Animal	<i>Abortive</i> .—Ergot, savin, plumbago.		Nerine	On blood
			<i>Nerine</i> —Laburnum, yew, oxalic acid			
		Cerebral ..	<i>Hemolytic</i> —Abrus, ricinin, saponin		On brain	
Venomous snakes						
Cantharides and arthropod poisons, e.g centipedes, scorpions, wasps						
Putrid food and fish—ptomaines						
Trichiniasis and tapeworm						
(Auto-intoxications)						
Opium and morphine						
Chloroform, chloral, cocaine						
Cerebro-spinal, cardiac, etc	Spinal ..	Alcohol, ether, phenacetin, sulphonal, carbolic acid, creosote, fusel oil, naphtha, benzol, petroleum, nitrobenzol, nitroglycerine, aniline, camphor, and turpentine		Inebriants	On cord	
		Belladonna, datura, hyoscyamus, Indian hemp, cocculus, indiana, lathyrus, poisonous fungi				
		Strychnine and nux vomica, brucia, gelsemium.				
		Depressants	On heart			
						Asphyxiants
	Peripheral			Nerve-endings		

and tend, as a rule, to cause death by asphyxia, from spasm or paralysis of the respiratory muscles (3) Cerebro-spinal acting of both systems. (4) Cardiac poisons, or such as act mainly on the heart and tend to cause death by syncope.

Many poisons possess more than one of the above described actions, and may therefore be classed in more than one of the above groups. Thus, some poisons possess both a marked local irritant action, and a specified remote action on the nervous system, and may be called 'neuro-irritants,' and such of these irritants that act on the brain may be called 'narcotico-irritants,' e.g. aconite. Some neurotic poisons, again, have a marked action on both the brain and spinal system, or on both the brain and the heart, and hence arise the terms cerebro-spinal and cerebro-cardiac poisons.

Action of Poisons.

A poison may produce its effects by being administered by the mouth, into the lungs, absorbed through the skin, injected into a wound, or introduced into the rectum, or vagina, or ear. A good many cases of fatal poisoning nowadays occur from intravenous administration of salvarsan, antimony tartrate, etc., and many from intrathecal injection of stovain, novocain, etc., in spinal anæsthesia.

The action of a poison may be (1) local, or (2) remote, and the same poison may possess both a local and a remote action.

Local action of a poison results from its direct application to the part and may consist in the production of (a) Corrosion, i.e. chemical destruction, as in the case of the strong mineral acids, (b) Irritation and inflammation, as in the case of cantharides, tartar emetic, etc.; or (c) Certain nervous impressions, as in the case of opium, aconite, cocaine, etc.

Remote action of a poison may be of a non-specific or specific character. **Non-specific.**—Poisons which possess a remote non-specific action on the system, producing thereby an effect similar to that which often results from severe mechanical injury. Extensive corrosion produced by a corrosive acid may, for example, be followed by shock, as a remote non-specific action. **Specific.**—This may consist in the production of tetanic spasm, as in poisoning by strychnine; syncope, as in poisoning by tobacco; nephritis, as in poisoning by cantharides; gastritis, as in poisoning by arsenic, etc., etc. The remote specific action of a poison results from the absorption of the poison into the system through the blood. Absorption takes place with extreme rapidity. Blake, from his experiments, inferred that a poison might be diffused through the whole body in nine seconds;

and Erichsen, in a case of extroversion of the bladder, found potassium ferrocyanide in the urine one minute after it had been given by the mouth on an empty stomach. As poisons are absorbed into the system through the blood, it indicates the advisability, in the case of poisoned wounds, of applying a ligature above the wounded part, and endeavouring to remove the poison from the wound by excision and suction. Again, it indicates that after death, absorbed poisons will probably be found, in greatest quantity, in organs containing much blood, *e.g.* the liver.

In some cases the remote action may be the result of 'sympathy,' that is, of impression conveyed to the nerve-centres by the nerves, as where hydrocyanic acid kills in two seconds.

Causes modifying the action of a poison. These are:—

1. Quantity.—The administration of a large dose of some poisons is sometimes followed by symptoms differing greatly in character from those which follow a moderate dose, *e.g.* moderate doses of arsenic produce irritant symptoms, very large doses sometimes cause death by shock without irritant symptoms (see *Case (3)*, p. 476).

2 Form.—(1) **Physical.** Poisons act most rapidly when gaseous, next, when liquid; next, if in fine powder; and least rapidly when in solid masses (see p. 479). (2) **Chemical.** This may render an active poison inert, *e.g.* corrosive acids may be rendered inert by combination with alkalis; or (b) it may render the poison more soluble, increase the rapidity with which it acts, or, by rendering it less soluble, diminish the rapidity of its action.

3. Mechanical mixture with inert substances, *e.g.* dilution or mixture with inert powders, in some cases may alter the character of the symptoms, for example, corrosive acids, when diluted, act as irritants only. In other cases, mechanical mixture with an inert substance, by protecting the poison from absorption, may delay its action, hence poisons, as a rule, act less rapidly when given on a full stomach. Again, animal charcoal, by taking up a poisonous alkaloid and rendering it insoluble by adhesion, may delay or prevent its action.

4. Mode of application.—This, by affecting rapidity of absorption, affects the rapidity of action of poisons. Modes of introduction enumerated in order of rapidity of action, the most rapid first, are (1) injection into a vein, (2) application to a wound, (3) application to a serous surface; (4) application to the broncho-tracheal mucous membrane, (5) introduction into

the stomach; (6) injection into the rectum, and (7) application to the unbroken skin

5. Condition of body.—(1) *Habit*.—This, in the case of many poisons, *e.g.* opium, alcohol, and tobacco, tends to confer on the system a resisting power to the action of the poison to the use of which the individual is habituated. (2) *Idiosyncrasy*.—This may show itself either in abnormal sensitiveness (or the reverse) to the action of a particular poison—*e.g.* mercury; or the individual may be exceptionally effected by a drug, *e.g.* purged by opium, or by an article of food (see *fish-poisoning*). (3) *Disease*.—This, if the symptoms of the disease resemble those produced by the poison, tends to confer increased sensitiveness to the action of the poison: *e.g.* narcotics in advanced renal disease. If, on the other hand, the symptoms of the disease are opposed in character to those produced by the poison, diminished sensitiveness to the action of the poison may be the result: *e.g.* narcotics in tetanus. (4) *Sleep and intoxication*.—These may delay the action of a poison (see *Cases*, p. 479). (5) *Accumulation*.—Small doses of a poison, each insufficient to cause any serious effect, if given one after the other at short intervals, may accumulate in the system and produce serious effects. Accumulation obviously tends to occur when the rate of elimination of the poison is slower than the rate of its administration. Hence poisons which are only slowly eliminated from the body—*e.g.* lead and mercury, and metallic poisons generally—are specially prone to act as cumulative poisons. Organic poisons are, as a rule, quickly eliminated. In some, however—*e.g.* strychnine—the rate of elimination is comparatively slow, and accumulation tends to occur.

Treatment of Poisoning.

As immediate treatment is so essential, it is advisable to keep an emergency case in readiness for cases of poisoning.

The indications of treatment in cases of poisoning are:—(1) Elimination; (2) Prevention of action; and (3) Counteraction and removal of effects.

1. Elimination.—The measures to be adopted for the purpose of procuring elimination of a poison vary with the mode in which the poison has been administered. Thus, if the poison has been injected into a wound, excision of the wounded part and suction are indicated. If the poison has been inhaled into the lungs, the patient must be made to inhale pure air, so that the poison may thereby be chased out of the lungs. If the poison has been taken into the stomach, (1) the

stomach-pump should be used, except in cases of corrosive poisoning, care being taken to inject warm water before proceeding to exhaust, and always remove a little less than the quantity injected; the stomach-pump (or soft rubber catheter in young children) should always be used without delay in serious cases; (2) where the stomach-pump is not available, and in milder cases, and especially in children, promote vomiting by the administration of warm water, or set up by tickling the fauces, or much better by the administration of emetics, *eg* mustard and water (one tablespoonful of mustard to half a pint of water for an adult—this has no depressant action at the time or after), or 20 to 30 grain doses of sulphate of zinc, or powdered ipecacuanha, or subcutaneous injection of one-tenth to one-fifth of a grain of apomorphine. Or special treatment may be necessary for the elimination of absorbed poisons, *eg* the administration of potassium iodide, in cases of poisoning by lead.

2. Prevent action or absorption.—The nature of the measures by which this is carried out varies with the poison, thus:—(1) when the poison is not corrosive or mechanical in action, prevent absorption (*a*) by the administration of substances to render the poison insoluble by **antidotes** (see list in *Appendix*), *eg* albumen in cases of poisoning by corrosive sublimate; freshly prepared hydrated ferric oxide in cases of poisoning by arsenic, sulphates in cases of poisoning by lead, etc., etc; or destroy the poison, *eg* cauterize poisoned wounds, or (*b*) by mechanical means, *eg* apply a ligature above the wounded part, in cases of poisoned wounds. (2) In corrosion or destruction of the tissues administer antidotes to

the administration of matters which will mechanically protect the tissues from the action of the substance swallowed: *eg* the administration of bulky food, in cases where pounded glass has been taken.

3. Counteract and remove effects.—In some cases of poisoning this may be done by administering physiological antidotes or substances which exert an action on the system opposed to that of the poison; *eg* atropine in poisoning by opium (see list of antidotes in *Appendix*). In other cases this indication is carried out by various measures calculated to counteract or remove the effects of the poison; *eg* the use of cold affusion and galvanism in narcotic poisoning; of warmth

to the surface, stimulants, and the recumbent posture in cardiac poisoning; of artificial respiration in cases where the poison taken is one which, like opium and conium, tends to cause death by other systems (Schaefer's or demulcent. Special measures for eliminating the absorbed poison, already referred to under 'Elimination,' may also be included under the head of measures directed to the removal of the effects of the poison.

Evidence of Poisoning.

The evidence pointing to the administration of poison may be derived from: (1) The symptoms; (2) The *post mortem* appearances; (3) Chemical analysis; and (4) Experiments on animals.

1. THE SYMPTOMS MAY BE GENERAL OR SPECIAL.

General.—1. Sudden onset.—This character, however, may be absent in a case of poisoning, *e.g.* in chronic poisoning by lead, mercury, phosphorus, etc.; and may be present in cases not due to poisoning, *e.g.* apoplexy, cholera, etc. 2. Increase in severity.—This character, like the last, is often present in disease. Again in some cases of poisoning, this character is absent, *e.g.* in the remittent form of opium poisoning (see *Case* below); and in cases where small doses of a poison are administered at short intervals.

“ck voice to give
lasted about five
profound coma,
taken.”—Taylor,

3. Uniformity, *i.e.* with the known effects of a particular poison; hence gastritis followed by salivation, as in acute mercurial poisoning, or by paralysis, as in arsenical poisoning, do not form exceptions to this rule. 4. Begin soon after taking food, drink, or medicine.—This character may be absent owing to the symptoms of poisoning being delayed in their appearance

by sleep, or by intoxication (see *Cases a, b and d*, p. 479); or by the counter-active effects of another poison simultaneously administered. Or again this character may be absent, owing to the nature of the poison swallowed; for example, sparingly soluble lead salts only give rise to acute symptoms after an interval of several hours, and a similar interval is often noticed in cases of fish poisoning. This character also may be present in cases not due to poison, *e.g.* cholera, apoplexy, etc., may come on soon after a meal, or rupture of the stomach may occur; and symptoms closely resembling those of poisoning have appeared from swallowing, after exertion, a quantity of cold fluid (see two following cases).

Case—Sudden death from swallowing, while heated, a quantity of cold fluid.—“A man sweat, after a bath of water fresh; he laid his hand on his stomach, and in a few minutes expired.”—Christison, *Poisons*, p. 120.

Case—Another.—Death on the fifth day.—A soldier, after a hurried journey on a hot day, swallowed a quantity of iced beer. Six hours afterwards, shivering set in, followed by vomiting, anxiety, thirst, and frequency of the pulse. This was followed by great prostration, hiccough, and lividity of face. Death took place on the fifth day. On *post mortem* examination, the mucous membrane of the stomach was found much reddened, and spots of extravasation were present. The stomach contained blackish matter, similar to what had been vomited during life.—*Ib.* p. 121

5 Other individuals are affected who partook of the same food, etc. This is a very striking character, it may, however, be present in disease, *e.g.* where, as sometimes happens, several persons after partaking of a meal together are nearly simultaneously attacked by cholera. This character may be apparently absent in a case of poisoning, *e.g.* where (as in *Case* below), of several persons present at a meal, only one partakes of a particular dish. Poisoning also may be indicated by the fact that several persons have suffered from suspicious symptoms, after partaking of articles of food, etc., which have passed through the hands of one and the same individual; although the attacks occurred at different places, and at different times (see *Case*, p. 446).

Case.—One only of a number killed by poison.—In a case which occurred in Poona, a man was reported to have died six or seven hours after partaking of food at a feast with about one hundred and twenty five other persons. No complaint was made by his relations, and the body was buried. Some days afterwards, an anonymous writing was found outside the Magistrate's Court, stating that deceased had been poisoned, and an inquiry was ordered. It then turned out that deceased being of a different caste to the other persons present at the feast, was served

with food separately from the rest by a separate person, and that before death he suffered from symptoms of irritant poisoning. The body was then (eleven days after death) exhumed, and the viscera forwarded for analysis, when about twenty grains of arsenious oxide was found in the contents of deceased's stomach.—*Bombay Chemical Analyst's Report*, 1880-81

Case.—Homicidal poisoning by colchicum—Catherine Wilson was

years, and in the other two six years, after death, but in all four cases no poison could be detected on analysis of the viscera.—*R. v. Catherine Wilson*. Taylor, *Poisons*, p 512.

6. Appear in persons previously in good health.—This character may obviously be absent in cases of poisoning, or present in cases of disease. 7. Prove rapidly fatal.—This character, like the last, is one which may be absent in poisoning and present in disease.

Obviously the greater the number of the above characters present in the same case, the stronger is the suspicion of poisoning; and *vice versa*, the smaller the number, the weaker the indication of poisoning.

Special symptoms of poisoning vary with the class to which the poison belongs.

1. **Irritant poisons**, see p. 456, etc.—Certain diseases are accompanied by symptoms more or less resembling in special character those of poisoning, *eg* : The chief affections simulating the effects of poisons of this class, are :

- (a) **Cholera**.—This is specially liable to be mistaken for arsenical poisoning, and *vice versa* (see *Arsenic*, p 477).
- (b) **Gastritis**, following the imbibition of a large quantity of cold fluid, whilst the body is cooling after violent exertion (see *Case*, p. 445). Or, under such circumstances, death may occur from shock (see *Case*, p. 445), and the case resemble one of rapidly fatal narcotic poisoning, *eg* by hydrocyanic acid. Idiopathic gastritis is very rare, and is not accompanied by the violent purging usually present in irritant poisoning.
- (c) **Rupture of stomach**, complete or partial, especially when

due to over-distension (see *Case* below), may closely simulate irritant poisoning. So also may perforation of the stomach from disease, rupture or perforation of the intestines and rupture of the biliary ducts, uterus, or uterine appendages. In cases such as these the *post mortem* appearances will indicate to what the symptoms have been due. (d) **Colic.**—There may be some difficulty in diagnosing this from acute irritant poisoning, especially by lead salts. Pressure, however, in acute irritant poisoning augments the pain, while in colic it often relieves it. (e) **Enteritis, peritonitis and intussusception.**—These affections, like acute poisoning by lead salts, are accompanied by constipation. Unlike irritant poisoning, in the later stages of these affections, vomiting, if present, becomes stercoraceous.

Case.—Rupture of the stomach; symptoms like irritant poisoning.—A boy aged fourteen, after eating and drinking heartily at a feast, was attacked with violent vomiting and purging. Next morning he was unable to swallow, his pulse became irregular, and pressure on the heart or stomach caused excruciating agony. These symptoms continued, and on the following day, after having vomited at intervals altogether about two pounds of blood, the boy died. On *post mortem* examination, the inner coat of the stomach was found torn in many places, and that of the duodenum lacerated almost completely round—Taylor, *Poisons*, p. 118.

2. Cerebral poisons (see Chap. XXX.).—The chief affections simulating the effects of these are—(a) Apoplexy and uræmic coma.—These may more or less resemble poisoning by opium, or narcotics similar in action thereto (see *Opium*). (b) Epilepsy.—A fatal attack of this affection might possibly be mistaken for hydrocyanic acid poisoning. Death, however, seldom results from a first attack of epilepsy, and a history of previous attacks would indicate the nature of the case. (c) Sudden death from heart disease.—This may be mistaken for hydrocyanic sometimes of chloral. heart disease would, of course, tend to indicate death from disease. In some cases of sudden death from heart affection, however, no marked appearances of the heart are discoverable after death.

3. Spinal poisons (see Chap. XXIX.)—The effects of poisons of this class may be more or less simulated by—(a) Tetanus.—This closely resembles strychnine poisoning (which see). (b) Cerebro-spinal meningitis. This affection is accompanied by tetanic spasms, more or less resembling those of strychnine poisoning. Unlike strychnine poisoning, headache,

fever, hyperæsthesia, and delirium precede the tetanic symptoms. (c) Convulsions in young children proving (as sometimes happens) rapidly fatal may simulate poisoning, the more so as opium poisoning in children is often accompanied by convulsions. In some cases the attack may be traced to dentition, indigestion, worms, or other source of irritation, but sometimes no cause for the attack is discoverable.

4 **Cardiac poisons** (see Chap. XXX.).—The effects of a poison of this class may be simulated by heart disease (see above), or by sudden death from embolism, especially of the pulmonary artery. In this last case, the discovery of a plug obstructing the affected vessel would indicate the cause of death.

2 POST MORTEM APPEARANCES IN POISONING.

Many poisons leave no characteristic *post mortem* appearances, but irritant poisons usually leave well-marked signs of their action. Such signs may consist in the presence of—

1. **Redness of the mucous membrane of the stomach** and other portions of the alimentary canal, due to inflammatory action. Such redness may be the result of disease, but is usually the result of the administration of an irritant poison. When due to poisoning, the redness may vary in degree from unusual vascularity to a deep red velvety appearance. The mucous membrane is softened and opaque, and may show dark patches, due to underlying extravasated blood. Often its surface is covered with a glairy tenacious mucus, in which particles of the poison may be found entangled. Usually, in irritant poisoning, these appearances are chiefly met with in the stomach. Redness due to inflammatory action may be more or less simulated by—

(a) **Staining with red dyes.**—Chemical tests will usually distinguish this, most vegetable reds being turned either blue or green by alkalis or yellow by acids. Examination under the microscope also will, in such cases, show that the redness is not due to distension of the blood vessels. (b) **Congestion.**—In some cases of sudden death, especially from congestion of the brain, or from cardiac disease,¹ the mucous membrane of the stomach is found congested, and patches even of extravasated blood have been found beneath it. On dissection, the mucous

¹ stomach mucosa from gastritis or irritant calling a condition of

1. In some cases of sudden death, especially from congestion of the brain, or from cardiac disease, the "cardiac stomach."

membrane is found to be tough and transparent, and not as in irritant poisoning, softened and opaque from inflammation.

2. **Discolorations** other than redness of the parts with which the poison has come into contact.

In some cases such discolorations are met with in the alimentary canal. Thus, in arsenical poisoning, yellow patches, due to conversion of arsenious oxide into sulphide, are often found on the mucous mem-

3. **Ulceration** of the mucous membrane of the stomach.—Ulceration from disease must not be mistaken for this.

Generally, but not always, in disease, the ulcer is only just surrounded

4. **Corrosion or chemical destruction** of the tissues, and *perforation of the stomach*.—In cases of corrosive poisoning marks of corrosion may be found on the skin, or in the mouth, throat, or œsophagus, or on the mucous membrane of the stomach. Perforation of the stomach may be found; this, however, is comparatively rare in poisoning.

Post mortem softening of the stomach, with or without perforation due to the action of the gastric juice, is sometimes met with, and must

5. be found in the or gaseous irritant, in the case of certain irritant poisons, *eg.* cantharides, in the kidneys or urinary passages. A yellow tinge of the skin is a common *post mortem* appearance in acute poisoning by copper and phosphorus, and in the latter, fatty degeneration of the liver is almost always present.

Some non-irritant poisons, *eg.* hydrocyanic acid, emit, on opening the body, a particular odour, which may indicate the nature of the case. In others during the *post mortem* examination, portions of the poison used, *eg.* datura seeds, may possibly

be found and identified. In the great majority, however, the *post mortem* appearances present merely indicate the 'mode' of death (coma, asphyxia, etc.), and are therefore consistent with death from causes other than by poisoning.

Directions for making a Post Mortem Examination in a Case of Suspected Poisoning.

The chief points requiring special attention are:—

1 Examine the state of the pupils.

2 Examine surface and orifices of the body, especially the mouth and throat, for marks of corrosion.—This is most important. It frequently happens that in corrosive poisoning, chemical analysis can do no more than prove the existence in the viscera of a salt, e.g. a sulphate or an oxalate, which may have been derived from the poison swallowed, or may have been introduced into the body as a constituent of an article of food or medicine. In such a case failure to examine the mouth and throat for marks of corrosion may make it impossible to prove that death was due to poison.

3. **Stomach**, mucous membrane and alimentary canal should be examined at the time the *post mortem* inspection is made. Appearances indicative of the action of a poison are liable (from decomposition, or from the action of preservative fluids) to disappear from the mucous membrane. Hence, after removal of the stomach and intestines, these should be cut open, and their internal appearance noted. Suspicious particles found adhering to the mucous membrane of the stomach should be picked off, and preserved separately. (See rules in *Appendix XVI.*)

4. **Preserve matters for analysis.**—In addition to the stomach, its contents, and the kidney, and a portion of the urine, should always be preserved, or a sufficient portion, in entire failure of the chemical analysis. For the purpose of preventing decomposition, spirit should be added to the matters preserved (except, of course, to fluid matters, in cases of suspected alcoholic poisoning) or a saturated solution of common salt may be used in certain cases. It is desirable to retain a sample of the spirit or salt-solution used, in case any question should arise in regard to its purity. The vessels containing the

matters preserved for analysis should be sealed, and care taken to prevent their being tampered with.

5. Transmit articles for analysis.—To secure identity, the containing vessels should be properly labelled, and an impression of the seal used in closing them (which, of course, should be a private seal), enclosed in the letter advising their despatch. The box containing the vessels should be franked. A summary of the case should always be forwarded to the analyst. It must be recollected that the quantity of matter available for analysis is limited, and that the quantity of poison present is frequently very small. Sub-division, therefore, of the matters under examination is to be avoided as much as possible, and this cannot be the case if the analyst is given no guide to the class of poison to be searched for, and as a rule he cannot begin his analysis until the full report is received by him.

6. Examine rest of the body.—This should never be neglected. It should be remembered that even in cases where the suspicion of poisoning is strong, death may have been due to cause other than the administration of poison. Also that *post mortem* appearances, indicative of disease or injury, may be found co-existing with appearances indicating death from poison, and that in such cases the fact of the existence of the disease or injury may, even when death has been clearly due to poison, be important as bearing on the question of suicide or homicide. In the case of female bodies care should always be taken to examine the vagina. Poisonous matters, or traces left by their action, are frequently found in the vagina, in cases where death has been the result of an attempt to procure abortion. Even also in other cases poison may be found in the vagina (see 'Opium Poisoning').

3. CHEMICAL ANALYSIS.

This is usually performed by an expert chemist, as the ordinary medical man has not the requisite technical skill or appliances for the delicate processes necessary. The object of chemical analysis is to ascertain (1) the presence and character of the poison, (2) if possible, the quantity of poison taken, and (3) how the poison was administered, etc. The detection of poison in the body is the most important proof of poisoning, it is improbable to have been introduced after death—if found deposited in the solid organs could not have been so. When poison is found there is the question whether it was the cause of death, for death may be the result of other injury, etc. On

the other hand, poison may disappear from the body by vomiting, purging, or by the urine or be decomposed. Poisons, after absorption, tend to undergo elimination by natural effort, *eg* by the lungs, skin, or kidneys. Hence, during life, in cases of poisoning, poisons may be detected by analysis in the urine, and if, in a case of poisoning, life is prolonged for some time, no poison may, after death, be discoverable in the body. The longer life is prolonged, and the more soluble or volatile the poison, the more likely is this to occur. Complete elimination has been known to take place, in a case of arsenical poisoning, in a fortnight; and, in a case of antimonial poisoning, in a week, and may occur very rapidly in the case of very volatile poisons, like hydrocyanic acid and chloroform.

Poison may be detected by analysis:—(a) *Before death* in the (1) vomit, (2) urine or in other evacuation; (3) or in food, or other suspected articles. (b) *After death*, in the contents of the stomach or intestines; or, owing to absorption, in the liver, kidneys, or other parts of the body.

portions of these to analysis. For the composition of poisonous proprietary medicines, see Martindale & Westcott's Extra Pharmacopœia II.

When a poison is found, it does not necessarily imply poisoning. Poison may be introduced into an article of food, in order to support a false charge. Again, poison may be introduced into evacuations, or even into viscera, with a similar object; or these may have become accidentally contaminated with poison from impurities in the containing vessel. Hence the importance of (1) if possible, securing for analysis vomit, etc., ejected in presence of the medical attendant; (2) using only thoroughly clean vessels holding matters to be analysed, and (3) preserving such matters under seal, etc., so as to prevent their being tampered with. Suppose, however, that poison is found, and that such poison has not been introduced in one of the ways indicated above, the case may still not be one of poisoning, because the poison discovered—

(a) May be a natural constituent of articles of food, *eg* oxalic acid in combination is found in certain vegetables; or, (b) May have been given in the course of medical treatment, *eg* arsenic or mercury (see these poisons). In two other cases also, a poison, or substance resembling a poison, may be found in the viscera of an individual, and the case yet be not one of death from poison, viz.:—(c) When death has been due to

some other cause, *e.g.* drowning or hanging, operating before the poison has fully exerted its action on the system; or, (d) When the substance found is a 'Ptomaine,' or alkaloid resulting from decomposition (see 'Ptomaines').

The total quantity of poison found in the viscera of an individual may be less than a minimum poisonous dose, and the case may yet be one of death from poison. Frequently a large proportion of the poison swallowed is got rid of by evacuation. In this way, the whole alimentary tract may be freed from the poison, and only that portion which has been absorbed remain in the body. This absorbed portion again is distributed more or less throughout the whole body. Obviously, however, only a fractional part of the body can be examined, and the quantity of poison found in this, therefore, is only a fraction of the quantity the body contains. Again, by elimination through the excretories during life, a portion, or even the whole of the absorbed poison, may be removed from the body, and yet death occur from the effects of the poison. In such a case, the whole body may not contain such a quantity of the poison as amounts to a minimum fatal dose.

On the whole, therefore, the quantity of poison found in the body is, in the great majority of cases, of little importance. In a few cases, however, it may be important, *e.g.* when the quantity found is small, and the poison is one sometimes present as a natural constituent of food, or sometimes given as a medicine. Hence, where possible, the quantity present should always be determined.

When no poison is found, the case may yet be one of poisoning, under the following circumstances —

(a) From the poison having disappeared by evaporation or by evacuation or elimination. Thus, as already pointed out, is specially likely to occur in the case of very volatile, *e.g.* gaseous poisons, or in the case of very soluble poisons, *e.g.* in poisoning by the corrosive acids, or in case where an individual has lived for some time after swallowing the poison. (b) From neglect to submit certain matters (or a sufficient quantity thereof) to analysis, *e.g.* in cases where the individual has lived for some time after administration of the poison, and no portion, or only very small portions, of the solid viscera, are submitted to the analyst. Again, of several articles of food, one alone may contain poison, and this may not have been submitted. (c) From the poison having undergone chemical destruction by oxidation or putrefaction. This may occur in the case of organic, but not in the case of inorganic poisons. It is possible that some organic

poisons may undergo destruction by oxidation in the body during life. Organic poisons, again, may be destroyed by putrefaction after death; some, however, *eg.* strychnine and opium, have been found to resist putrefaction, there being no reliable substances containing it.

(c) From want of care or skill on the part of the analyst. The case of *R. v. Catherine Wilson* (p. 446) is an example of a conviction for murder by poison, notwithstanding the fact that no poison was discovered in the viscera of the persons poisoned.

Should a poison be found, a portion of it should, if possible, be preserved for production before the Court (*Ind. Evid. Act*, s. 60).

4. TEST-EXPERIMENTS ON LOWER ANIMALS.

The evidence from experiments on animals, the 'physiological test,' with the contents of the stomach and vomited matter or extracts from these, may take the form of—

1. **Administration of suspected substances**, such as portions of (a) Food.—This is often employed as a rough preliminary test for the presence.

An experiment of this kind

and is open to the fallacy that

when swallowed by animals, cause symptoms of poisoning. (c) **Eliminated poison**.—This is especially useful in the case of organic poisons for which there are no distinctive chemical tests, *eg.* aconitia and daturia (see, however, remarks on 'Poisoning').

This is the ordinary physiological test for aconite and datura—the extract by *Sass*' or other process for extracting alkaloids is put into the eye of a cat, or administered internally to a cat by the stomach-pump.

2. **Comparison experiments**.—In the case of suspected poisoning by a substance the action of which is not well known, it may prove useful to administer to an animal a dose of the poison supposed to have been employed, so that the symptoms present in the case may be compared with those which arise in the animal experimented on. Experiments of this kind are open to two objections.

(a) Some animals are apparently unaffected by poisons, which act violently on man, and herbivora are as a class less affected than carnivora, *eg.* pigeons appear to be unaffected by opium, some varieties of monkeys appear to be unaffected by

strychnine, and rabbits appear to be unaffected by belladonna, and fowls by strychnine. It should be noted, however, that poisoning in the human subject may arise from eating the flesh of animals that have fed on plants not poisonous to the animal, but poisonous to man. (b) The symptoms produced in the animal experimented on may be different from those of the case, although the same poison was used in both; either from the action of the poison on the animal being different to its action on man, or from failure to properly proportion the dose to the size of the animal.

The weight of the animal used in the experiment should always be recorded with the weight or quantity of suspected poison administered. In every case a 'control' experiment should be made on a second animal of the same species, and as far as possible of the same size and weight.

CHAPTER XXIII.

CORROSIVE AND IRRITANT MINERAL POISONS.

General Symptoms of Irritant Poisoning.

THESE are divisible into (a) Throat symptoms; (b) Abdominal; and (c) Later symptoms. (a) Throat symptoms.—These are pain, difficulty in swallowing, and feeling of constriction; and (in corrosives) marks of corrosion in the mouth and throat. (b) Abdominal symptoms.—These are epigastric pain, thirst, and dysuria. The stools d. (c) Later symptoms.

—~~irritation of~~ pain, and inflammatory fever; or collapse accompanied by a quick feeble pulse, and cold sweats, sometimes the anus becomes excoriated. Various symptoms due to the specific remote action of the poison may also be present, and in cases which survive, stricture of the gullet may result.

The order in which the symptoms appear varies according as to whether the case is one of corrosive, or of non-corrosive irritant poisoning. In corrosive poisoning, the throat symptoms appear first, and come on immediately, or almost immediately, and often the glottis and trachea are affected, causing dyspnoea. In non-corrosive irritant poisoning, the abdominal symptoms appear first, and are followed by throat symptoms. In non-corrosive irritants, the interval between swallowing the poison and first appearance of the symptoms varies; it may be very short in the case of the more soluble irritants, or may be half an hour or more in the case of less soluble ones.

Death may occur.—(a) Rapidly from shock, as in some cases of arsenical poisoning; or from suffocation, as in some cases of corrosive poisoning. (b) Less rapidly from syncope due to absorption and secondary action, as in some cases of oxalic acid poisoning. (c) Still less rapidly from exhaustion due to protracted irritation; or (d) In corrosive poisoning, after

a considerable period, from starvation or suffocation, the result of local injury.

Post mortem appearances of irritant poisoning are signs of irritation or corrosion of the mucous membrane of the alimentary canal. In some cases, similar signs may be present in other situations.

Treatment.—In cases of irritant poisoning, the following indications should be followed:—1. **Elimination.** Usually there is free vomiting, which should be encouraged by copious draughts of warm water. In some cases, emetics or the stomach-pump may be required; the latter, however, should never be used in corrosive poisoning. 2. **Prevention of action.**—The means whereby this indication may be carried out have already been sufficiently indicated (see *ante*, p. 442). Here it may be noted that, in the case of vegetable and animal irritants, antidotes are, as a rule, not available. 3. **Counteraction and removal of effects.**—Under this head the employment of measures calculated to allay irritation—among them administration of demulcents—is indicated. Only demulcents must not be given in poisoning by phosphorus, or by cantharides, these poisons being soluble in oil. Stimulants may be given to counteract depression. In cases of corrosive poisoning, laryngotomy may be required.

Irritant poisons may be conveniently classified as—(1)

irritants.

Corrosive Mineral Acids.

The chief of these are—Sulphuric acid or oil of vitriol, hydrochloric or muriatic acid or spirit of salt, nitric acid or aqua fortis.

Action, and origin of cases.—These three acids are very similar in action, and are powerful corrosives, except when much diluted, when they act as simple irritants. Cases of poisoning by them are rare in India,¹ but tolerably frequent in Europe. Owing to their marked properties, these acids are seldom used homicidally; a few cases, however, of homicidal

¹ Only one case (suicide by nitric acid) occurred in the Bombay Presidency in twenty years.

poisoning of children by sulphuric acid are recorded. Accidental cases, except among children, also are rare. Most commonly adult cases of poisoning by these acids are suicidal, and in England form about one-twelfth of the total suicides by poison. Sulphuric acid has been injected by mistake into the rectum as an enema, and has been thrown up into the vagina for the purpose of procuring abortion. Not infrequently in England, and in rare cases also in India, sulphuric acid is thrown over the person in order to cause injury ('vitriol throwing'). Sometimes nitric acid is used in the same way. A few accidental fatal cases from inhalation of the vapours given off by nitric acid (see *Nitrous Acid*) have occurred; and a case of homicide by pouring nitric acid into the ear during sleep is on record.

General Symptoms.—Swallowed in a tolerably concentrated condition these acids cause: Immediate burning pain in the mouth and throat, followed by pain in the abdomen. Vomiting of brown or black matter containing blood, mucus, and shreds of mucous membrane. The vomited matters, especially those first ejected, may effervesce on coming into contact with the ground (owing to the acid acting on carbonates). There is tenesmus, but no purging; difficulty and pain in micturating, in swallowing, and often also in breathing. The lips and interior of the mouth, unless the poison has been conveyed to the back of the throat by a spoon or some such means, are discoloured, or shrivelled and blistered. The discoloration, at first white, afterwards becomes ash-grey or brown, or, if nitric acid has been employed, turns yellow. Marks of the action of the acid may be found on the skin or clothes; these are stained yellow if from nitric acid, and brown—or, if on coloured cloth, dull red—when due to sulphuric acid. Hydrochloric acid does not stain the skin, but stains coloured cloth very much like sulphuric acid.

Special symptoms:—

Sulphuric acid.—Salivation coming on about the second or third day has been observed in several cases. In exceptional suicidal cases there has been considerable delay in the appearance of serious symptoms (see two undernoted cases), and in one case vomiting ceased in four hours, and did not return, although the patient lived thirty-one hours. In a few cases sulphate of indigo—a solution of indigo in strong sulphuric acid, used in dyeing—has been taken, giving rise to symptoms exactly like those of sulphuric acid poisoning; except that the mouth and vomited matters, and in some cases the urine also, are tinged blue.

Cases.—Poisoning by sulphuric acid; (a) appearance of urgent symptoms delayed.—A man, spoonful of oil of vitriol. upstairs He vomited brown fluid motion. There were no urgent fourth day.—(Taylor, P quantity of concentrate some friends, although death in a few hours —*ib.*

Hydrochloric acid.—In one case of poisoning by this acid salivation came on rapidly, in another convulsions preceded death, and in a third delirium came on on the second day, followed by paralysis of the limbs The vapour of hydrochloric acid if inhaled acts as a poison, causing great irritation of the air passages.

Case.—Hydrochloric acid poisoning.—In 1897 a man in Calcutta was advised to purchase half an ounce of hydrochloric acid from a baniah's of some disease from diluted acid, and died corrosive poisoning ally charred at several places, and yellow patches were found in mucous membrane of the

Waddell, *Beng Chem. Ex. Rept*, 1897

Nitric acid.—The immediate effect of nitric acid on the living tissues is to coagulate the albumen The strong acid produces a yellowish compound, *xantho-proteid acid*, which forms the typical yellow stain of this acid on the skin, mucous membrane, or clothes In one case of poisoning by this acid lockjaw was present, and in another insensibility. A case is recorded of poisoning by a mixture of nitric and sulphuric acids Nitro-muriatic acid is used in the arts for dissolving gold and other purposes, but does not seem to have given rise to any cases of poisoning. Death may occur rapidly from shock or suffocation. Children poisoned by sulphuric acid often die from the latter cause, the poison never reaching the stomach Hydrochloric acid poisoning also is apt to end in death by suffocation, due either to spasm, or later to corrosion and oedema of glottis. Death may take place less rapidly from exhaustion or, after months, from starvation, due to stricture of the oesophagus. In the case before referred to, where nitric acid was poured into the ear, death took place in thirteen weeks, from necrosis and inflammation spreading to the brain. Death usually takes place within twenty-four hours, but has occurred (in nitric acid

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General Symptoms.—Swallowed in a tolerably concentrated condition these acids cause: Immediate burning pain in the mouth and throat, followed by pain in the abdomen. Vomiting of brown or black matter containing blood, mucus, and shreds of mucous membrane. The vomited matters, especially those first ejected, may effervesce on coming into contact with the ground (owing to the acid acting on carbonates). There is tenesmus, but no purging; difficulty and pain in micturating, in swallowing, and often also in breathing. The lips and interior of the mouth, unless the poison has been conveyed to the back of the throat by a spoon or some such means, are discoloured, or shrivelled and blistered. The discoloration, at first white, afterwards becomes ash-grey or brown, or, if nitric acid has been employed, turns yellow. Marks of the action of the acid may be found on the skin or
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Cases—**Poisoning by sulphuric acid;** (a) appearance of urgent symptoms delayed.—A man, *æt.* fifty-six, swallowed by mistake a dessert-spoonful of oil of vitriol upstairs. He vomited brown fluid motion. There were no urgent fourth day.—(Taylor, *Poisons*, p. 183) (b) A girl having swallowed a quantity of concentrated sulphuric acid, sat quietly down to tea with some friends, although the quantity of acid taken was sufficient to cause death in a few hours.—*Id.*

Hydrochloric acid.—In one case of poisoning by this acid salivation came on rapidly, in another convulsions preceded death, and in a third delirium came on on the second day, followed by paralysis of the limbs. The vapour of hydrochloric acid if inhaled acts as a poison, causing great irritation of the air passages.

Case—**Hydrochloric acid poisoning.**—In 1897 a man in Calcutta was advised to purchase half an ounce of hydrochloric acid from a baniab's

places, and yellow patches were found in mucous membrane of the throat and gullet. No free acid was found in the stomach, as he was treated with alkaline medicines in the hospital. Sulphates were detected in the viscera, but abundance of hydrochloric acid, in combination with alkaline metals, was found in them as well as in the washings of the stomach received with the viscera. No nitric acid was detected.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Nitric acid.—The immediate effect of nitric acid on the living tissues is to coagulate the albumen. The strong acid produces a yellowish compound, *xantho-proteid acid*, which forms the typical yellow stain of this acid on the skin, mucous membrane, or clothes. In one case of poisoning by this acid lockjaw was present, and in another insensibility. A case is recorded of poisoning by a mixture of nitric and sulphuric acids. Nitro-muriatic acid is used in the arts for dissolving gold and other purposes, but does not seem to have given rise to any cases of poisoning. Death may occur rapidly from shock or suffocation. Children poisoned by sulphuric acid often die from the latter cause, the poison never reaching the stomach. Hydrochloric acid poisoning also is apt to end in death by suffocation due either to spasm, or later to corrosion and oedema of glottis. Death may take place less rapidly from exhaustion, or, after months, from starvation, due to stricture of the œsophagus. In the case before referred to, where nitric acid was poured into the ear, death took place in thirteen weeks, from necrosis and inflammation spreading to the brain. Death usually takes place within twenty-four hours, but has occurred (in nitric acid

poisoning) in an infant in five minutes, and in an adult in one hour and three-quarters. The longest fatal periods recorded are, in sulphuric acid poisoning, forty-five weeks, and in nitric acid poisoning two years, both from starvation, due either to stricture of gullet or to destruction of the peptic glands.

the more empty the stomach, the more easily is serious injury a result. Hence the least quantity required to destroy life cannot be precisely stated. The smallest doses which are recorded to have proved fatal are sulphuric acid, 1 drachm, nitric acid (in a child of thirteen), 2 drachms; and hydrochloric acid, about $\frac{1}{2}$ ounce. The largest non-fatal dose of sulphuric acid recorded is 3 ounces; and several instances of recovery after swallowing an ounce of hydrochloric acid are reported.

the stomach. Perforation of the stomach has been found in about a third of the fatal cases of sulphuric acid poisoning, is rare in nitric acid, and still rarer in hydrochloric acid poisoning.

Treatment.—The stomach-pump must **not** be used. Give calcined magnesia, carbonate of magnesia, chalk, or carbonate of soda, followed by mucilaginous drinks. If death from suffocation threatens, laryngotomy must be performed. In the after-treatment leeches and other antiphlogistic remedies may be required. Excoriations should be washed with lime-water and treated as burns. Distress due to inhalation of hydrochloric acid vapour may be relieved by inhalation of weak ammonia.

Detection.—In fatal cases of poisoning by these acids, especially if life has been prolonged for two or three days, no trace of the poison may be discoverable in the viscera. Should the presence of one of these acids be detected, it is important—salts of these acids being common constituents of food and medicine—to ascertain whether any of it is present in the free condition. If no free acid be found, the quantity of combined acid present becomes of importance. The quantity of free acid present is specially important in hydrochloric acid poisoning, as this acid (in loose combination with pepsin) is contained uncombined with bases in the gastric juice to the extent of about 0·2 per cent. or more.

Sulphuric acid and solutions of sulphates give a white precipitate with barium nitrate, which is (1) insoluble in dilute nitric acid, (2) insoluble in water, and (3) when collected, dried, and heated with powdered charcoal before the blowpipe, converted into barium sulphide, soluble in hydrochloric acid with a white precipitate, and by its odour, and by its reaction with lead acetate solution. Free

It may be separated from a solution on a water bath and treatment with quinine; separating the quinine sulphate formed, after thorough drying, by strong alcohol, in which quinine sulphate is soluble, but alkaline and metallic sulphates are insoluble. The alcoholic solution is then to be evaporated to dryness, the residue dissolved in boiling water, decomposed by ammonia, filtered, and the sulphuric acid estimated in the filtrate by precipitation as barium sulphate.

Hydrochloric acid and solutions of chlorides give (1) a white flocculent precipitate with silver nitrate solution, soluble in ammonia, but insoluble in boiling nitric acid, and (2) when boiled with H_2SO_4 and manganese dioxide, evolve chlorine, recognizable by its colour, odour, and bleaching action on moistened litmus paper. Free hydrochloric acid evolves chlorine when boiled with manganese dioxide only, and when mixed with HNO_3 dissolves gold. Organic mixtures to be tested for the free acid should be distilled, and the distillate tested for HCl , or if this, as sometimes happens, fails, resort may be had to either (1) the quinine process as for sulphuric acid described above, estimating the chlorine in the decomposed filtrate volumetrically with silver nitrate solution, or (2) the organic mixture may be divided into two equal portions, and one of these neutralized by solid carbonate, both are then evaporated to dryness, the residues incinerated, and the chlorine in each separately estimated. The excess of chlorine in the neutralized portion corresponds to the free acid present in the original fluid.

Nitric acid and solutions of nitrates (1) heated with H_2SO_4 and fragments of copper dissolve the copper with escape of lower oxides of nitrogen, known by their red colour and their liberating iodine from potassium iodide. (2) boiled with H_2SO_4 and a drop or two of indigo solution, decolorize the indigo (this test by itself is not conclusive evidence of the presence of HNO_3), and (3) if to a portion of the solution under test, ferrous sulphate solution and then a little H_2SO_4 be cautiously added, a brown ring appears at the point of contact of the H_2SO_4 with the other fluids. Free nitric acid gives the above reactions without the addition of H_2SO_4 and if mixed with HCl dissolves

poisoning) in an infant in five minutes, and in an adult in one hour and three-quarters. The longest fatal periods recorded are, in sulphuric acid poisoning, forty-five weeks, and in nitric acid poisoning two years, both from starvation, due either to stricture of gullet or to destruction of the peptic glands

Fatal dose.—The more concentrated the form in which these acids are swallowed the more likely is a given quantity to cause death. A very few drops of any of the three acids may cause death from suffocation; and the more empty the stomach, the more likely is serious injury to it to result. Hence the least quantity required to destroy life cannot be precisely stated. The smallest doses which are recorded to have proved fatal are sulphuric acid, 1 drachm; nitric acid (in a child of thirteen), 2 drachms, and hydrochloric acid, about $\frac{1}{2}$ ounce. The largest non-fatal dose of ' ' ' ' 3 ounces; and several instances of

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It may be separated from on a water bath and treatment with quinine; separating the quinine sulphate formed, after thorough drying, by strong alcohol, in which quinine sulphate is soluble, but alkaline and metallic sulphates are insoluble. The alcoholic solution is then to be evaporated to dryness, the residue dissolved in boiling water, decomposed by ammonia, filtered, and the sulphuric acid estimated in the filtrate by precipitation as barium sulphate.

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gold It may be separated from organic mixtures by the quinine process described above for sulphuric and hydrochloric acids.

Stains on cloth, etc.—The yellow stains of nitric acid on the tissues or on cloth, treated with weak caustic potash solution, acquire an orange colour, while iodine stains disappear, and bile stains remain unaltered. Stains of sulphuric or hydrochloric acid on dark-coloured cloth are usually reddish, the red tint disappearing on addition of ammonia. Sulphuric acid stains are more moist, and show more evidence of corrosion, than hydrochloric acid stains. If macerated in water, which water acid is present in the stain tested for the suspected acid.

at the same time be made with an unstained portion of the cloth Burns must not be mistaken for marks of corrosion by sulphuric acid. Blyth, on the authority of Maschka, mentions a case where free sulphuric acid found in a charred mark on an infant's bed was ascertained to be due to the sudden quenching with water of a live coal which had fallen thereon.

The detection of these acids may be required in criminal cases other than cases of poisoning or causing actual bodily hurt, as in a case where a bottle of this liquid, loosely stoppered and leaking, was sent by post, and a prosecution under the Post Office Act thereupon instituted against the sender. A mixture of HNO_3 and H_2SO_4 is used in making nitro-glycerine and other explosives; the identification of these acids, therefore, might be required in support of a charge of illicitly manufacturing such substances. Nitric acid is used in India for the purpose of 'sweating' silver coin; the method employed being apparently to steep the coins for a short time in this acid, and then, by adding metallic copper, precipitate and recover the silver. Hydrochloric acid has been used in forgery, to remove marks of writing ink from paper. Hydrochloric acid gas acts injuriously on vegetation, and by law in England alkali manufacturers—render the cake process—render the

to condense to a stated the manufacture. Hydrofluoric acid, HF , used for etching on glass, is a powerful corrosive. One fatal case is recorded of poisoning by this acid, in which half an ounce was swallowed, and death took place in thirty-five minutes.¹

¹ See *Physiological Action of Hydrofluoric Acid and Fluorides*, by L. A. Wardell, M.B.—*Ind. Med. Gaz.*, 1893.

Alkaline Corrosives.

The chief poisons of this class are the caustic alkalies; **potash, soda, and ammonia and their carbonates.** These, like the acid corrosives, act as simple irritants when sufficiently diluted. Cases of poisoning by the alkaline corrosives are rare, and usually accidental. One fatal case occurred in Bombay in twenty years, namely, a case of suicide by caustic ammonia.

In Europe, cases of poisoning by the corrosive alkalies are commonly accidental, and owe their origin to the extensive use of these substances in the arts, especially carbonates of potash and soda. Impure carbonate of soda is sold in the bazaars of Bombay under the names of *Sayikhara* and *Bangadakhara*; impure carbonate of potash, as *Jarakhara*, and the mixed carbonates as *Papadakhara*.¹

Symptoms.—These are similar to those caused by the corrosive acids, except that the vomited matters are alkaline and do not effervesce on the ground, and purging—which is not common in poisoning by the corrosive acids—is a frequent symptom in alkaline poisoning. In poisoning by liquid ammonia or its vapour, and by the carbonates of ammonia, inflammation of the air-passages is a constant symptom. Caustic ammonia is less corrosive than caustic potash and caustic soda, and carbonate of soda is less corrosive than carbonate of potash. As in poisoning by the corrosive acids, the greater the degree of concentration of the poison, the greater the danger. The *post mortem* signs and modes of death are similar to those in poisoning by the corrosive acids.

Treatment also is the same, except of course that dilute acids, preferably dilute vegetable acids, should be given instead of dilute alkaline solutions. In poisoning by ammonia inhalation of acetic acid vapour may be used to allay irritation of the air-passages.

Fatal dose, etc.—Forty grains of caustic potash caused the death of an adult in seven weeks from exhaustion. About half an ounce may be looked on as an ordinary fatal dose of caustic potash or caustic soda, and about half an ounce of carbonate of potash has in more than one instance, in adults, caused death in two to four months. Carbonate of soda is much less poisonous—a case of recovery after swallowing twelve ounces is on record. If caustic ammonia a quarter of an ounce of the strong solution has caused death, and half an ounce may be regarded as an ordinary fatal dose.

¹ *Sayikharam* is a name given to a mixture of Potash and Soda.

Liquor potassæ (B.P.) contains 5·84, and liquor sodæ (B.P.) 4·1 per cent of caustic alkali. Strong solution of ammonia (B.P.) contains 32½ per cent and solution of ammonia (B.P.) 10 per cent of NH_3 . Compound camphor liniment (B.P.) contains about 7·3 per cent. of NH_3 , and has given rise to more than one case of poisoning.

Detection.—Free potash and soda are most conveniently separated from organic mixtures by dialysis; after which the quantity present may be estimated (in the fluid which has passed through the membrane) by a standard acid. Free ammonia is best separated by distillation. Potash and ammonia are distinguished from soda by giving (1) a precipitate with a weak acid in excess, and (2) a precipitate with a weak acid in the presence of hydrochloric acid. Potash is distinguished from potassium salts (1) by their volatility, and (2) by their evolving ammonia when heated with solution of caustic potash.

Permanganate of potassium.—Fatal poisoning by permanganate of potassium appears to be very rare. Little or no reference is made in the current text-books on toxicology and forensic medicine to the poisonous action of permanganate of potassium.¹ The writers are only aware of one recorded case where death resulted from it. Several, however, have called attention to toxic symptoms following its use, and in the experience of one writer local sloughing followed the stupid and criminal procedure of subcutaneous injection in watery solution as an antidote for opium poisoning. Thomson (*Petersburger Med. Woch.*, 1895) records a case in which a large dose of solid permanganate of potassium caused corrosion of the pharynx and death in five hours from cardiac paralysis, which is quoted by Dixon Maun *apropos* of the use of solutions of permanganate in the treatment of poisoning by opium. Bidwell (*Boston Med. and Surg. Jour.*, vol. cxv. p. 141) quotes instances where serious symptoms followed the administration of permanganate of potassium. The sufferers were young unmarried females who were under treatment for amenorrhœa. In one case two consecutive doses of two grains were followed by intense burning pain from the throat to the pit of the stomach and serious collapse. In another a dose of one grain of the solid salt was followed by similar symptoms. In some correspondence (*Brit. Med. Jour.*, vol. i., 1895) on the possible dangers attending the use of this drug allusion is made to ulceration of the mouth attributed to local action of permanganate, and a case of abdominal pain and collapse following the administration is quoted by H. Powell. The actual quantity taken in the latter case is not clear. In another instance severe vomiting and collapse occurred after three two-grain doses had

¹ See C. H. Fox, *Lancet*, p. 411, 1893.

been taken at intervals. Judging from the condition of the coats of the stomach in their case no local mischief would have been inflicted by the use of the soft stomach-tube.

Case.—A woman, aged 47, after drinking heavily, took a ‘handful’ of crystals of permanganate of potassium and throwing them into a tascupful of beer drank the mixture. She was immediately taken to St. Thomas’s Hospital. On the way she was said to have vomited. When seen she was pale, conscious, but was unable to speak. Her lips, chin, fingers, and the front of the right forearm were stained dark brown. The tongue was quite swollen and almost black. The breath smelled strongly of stale beer. The skin was dry, the pulse was moderately rapid and of fair tension. After a few moments she struggled into a sitting posture and her breathing became slightly stridulous. Preparations were made for tracheotomy, but before anything could be done she fell back pulseless and the respiration stopped. By the stethoscope the heart could still be heard beating faintly and very slowly, although no pulse was perceptible at the wrist. Artificial respiration induced one or two respiratory movements. The heart sounds ceased altogether a few moments later. Death occurred 35 minutes after taking the poison. A necropsy was made 13½ hours after death. The chin, lips, and

The front part of
a part was of a deep
the glottis was red-
and showed no signs

scraping away the incrustation the mucous membrane was found to be intensely hyperæmic, presenting a bright pink blush. The destructive action of the salt was evidently very superficial. A little of the black

p. 411, 1899.

Lime, CaO .—May be included among the alkaline corrosives, but from its little solubility is much less dangerous than the poisons just described. The symptoms, treatment, etc., are the same as in poisoning by potash and soda. Malingerers have been known to produce ophthalmia by applying lime to the conjunctiva. **Other corrosive salts.**—Certain metallic salts, *e.g.* mercuric chloride and zinc chloride, possess a corrosive action: these will be described with the other compounds of these metals. A more or less destructive action on the tissues is also exerted by oxalic and acetic acid, see ‘Vegetable Acids’; by bromine, see ‘Non-metallic Irritants’; and by carbolic acid, see ‘Narcotics,’ group 2.

Liquor potassæ (B.P.) contains 5.84, and liquor sodæ (B.P.) 4.1 per cent of caustic alkali. Strong solution of ammonia (B.P.) contains 52½ per cent and solution of ammonia (B.P.) 10 per cent. of NH_3 . Compound camphor liniment (B.P.) contains about 7.3 per cent. of NH_3 , and has given rise to more than one case of poisoning.

Detection.—Free potash and soda are most conveniently separated from organic mixtures by dialysis; after which the quantity present may be estimated (in the fluid which has passed through the membrane) by a standard acid. Free ammonia is best separated by distillation. Potash and ammonia are distinguished from soda by giving (1) a precipitate with tartaric acid in excess, and (2) a precipitate with platinic chloride in presence of hydrochloric acid. Ammonium may be distinguished from potassium salts (1) by their volatility, and (2) by their evolving ammonia when heated with solution of caustic potash.

Permanganate of potassium.—Fatal poisoning by permanganate of potassium appears to be very rare. Little or no reference is made in the current text-books on toxicology and forensic medicine to the poisonous action of permanganate of potassium.¹ The writers are only aware of one recorded case where death resulted from it. Several, however, have called attention to toxic symptoms following its use, and in the experience of one writer local sloughing followed the stupid and criminal procedure of subcutaneous injection in watery solution as an antidote for opium poisoning. Thomson (*Petersburger Med. Woch.*, 1895) records a case in which a large dose of solid permanganate of potassium caused corrosion of the pharynx and death in five hours from cardiac paralysis, which is quoted by Dixon Mann *apropos* of the use of solutions of permanganate in the treatment of poisoning by opium. Bidwell (*Boston Med. and Surg. Jour.*, vol. cxv, p. 141) quotes instances where serious symptoms followed the administration of permanganate of potassium. The sufferers were young unmarried females who were under treatment for amenorrhœa. In one case two consecutive doses of two grains were followed by intense burning pain from the throat to the pit of the stomach and serious collapse. In another a dose of one grain of the solid salt was followed by similar symptoms. In some correspondence (*Brit. Med. Jour.*, vol. 1, 1895) on the possible dangers attending the use of this drug allusion is made to ulceration of the mouth attributed to local action of permanganate, and a case of abdominal pain and collapse following the administration is quoted by H. Powell. The actual quantity taken in the latter case is not clear. In another instance severe vomiting and collapse occurred after three two-grain doses had

¹ See C. H. Fox, *Lancet*, p. 411, 1893.

been taken at intervals. Judging from the condition of the coats of the stomach in their case no local mischief would have been inflicted by the use of the soft stomach-tube.

Case.—A woman, aged 47, after drinking heavily, took a 'handful' of crystals of permanganate of potassium and throwing them into a tumblerful of beer drank the mixture. She was immediately taken to St. Thomas's Hospital. On the way she was said to have vomited. When seen she was pale, conscious, but was unable to speak. Her lips, chin, fingers, and the front of the right forearm were stained dark-brown. The tongue was quite swollen and almost black. The breath smelled strongly of stale beer. The skin was dry, the pulse was moderately

could still be heard beating faintly and very slowly, although no pulse was perceptible at the wrist. Artificial respiration induced one or two respiratory movements. The heart sounds ceased altogether a few moments later. Death occurred 35 minutes after taking the poison. A necropsy was made 13½ hours after death. The chin, lips, and interior of the mouth were stained a deep brown. The front part of the tongue was swollen and almost black, the back part was of a deep mahogany colour. The epiglottis was blackened, the glottis was oedematous. The stomach was moderately distended and showed no signs of inflammation externally. It contained about two pints of fluid with which was mingled a black insoluble powder and some parchment-like masses—probably portions of food. The mucosa was coated with a black granular powder, closely adherent, which could not be washed off. On scraping away the incrustation the mucous membrane was found to be intensely hyperæmic, presenting a bright pink blush. The destructive action of the salt was evidently very superficial. A little of the black deposit had escaped into the duodenum. The mucous membrane here was also hyperæmic, but there was no incrustation. The liver was enlarged and appeared fatty. The portion of the spleen near the stomach was soft and pulsatious, the rest of the organ was normal.—C. H. Fox, in *Lancet*, p. 411, 1899.

Lime, CaO.—May be included among the alkaline corrosives, but from its little solubility is much less dangerous than the poisons just described. The symptoms, treatment, etc., are the same as in poisoning by potash and soda. Malingerers have been known to produce ophthalmia by applying lime to the conj.

eg.
actin

metals. A more or less destructive action on the tissues is also exerted by oxalic and acetic acid, see 'Vegetable Acids'; by bromine, see 'Non-metallic Irritants'; and by carbolic acid, see 'Narcotics,' group 2.

CHAPTER XXIV.

IRRITANT NON-METALLIC POISONS,

Phosphorus.

RED or amorphous phosphorus is not poisonous, whilst ordinary yellow phosphorus, especially in fine division, is an extremely active irritant poison. It is contained, about $1\frac{1}{2}$ to 4 per cent., in various pastes used for destroying vermin, and to a varying extent, usually about 15 per cent., in the composition with which the heads of some kinds of lucifer matches are tipped.¹

Phosphorus vapour is also highly poisonous, but the symptoms produced by it usually differ from those of poisoning by solid phosphorus (see below).

Case.—Phosphorus poisoning by match-heads.—A case of attempted poisoning by phosphorus was reported from Purnea in 1897. The suspected substance consisted of a packet of betel-nut and a prepared betel, the pepper leaves (*pán*) mixed with catechu and lime for chewing. It was found to contain the tips of four lucifer matches. Phosphorus was detected in the match heads—L. A. Waddell, *Beng. Chem. Lr. Rept.*, 1897.

The symptoms in acute poisoning may appear almost immediately, but in many cases do not appear for one to six hours; in a few cases their appearance has been delayed longer, and one case is recorded where five days elapsed before they appeared.

The first symptoms are those of ordinary irritant poisoning with the following points of difference: (1) the breath may be phosphorescent and have a garlicky odour; (2) the vomited matters and other evacuations may be phosphorescent; and (3) diarrhoea is sometimes absent. Subsequently jaundice sets in,

¹ In other kinds the non-poisonous red phosphorus is substituted for the poisonous yellow variety, and the heads of 'safety' matches contain no phosphorus.

usually before the end of the third day, often after a remission of the symptoms, and is accompanied most commonly by (a) retention of urine followed by fatal coma, delirium being sometimes present, or less commonly by (b) hæmorrhage from the mouth bowels, and genito-urinary organs, and spots of purpura under the skin with death ultimately from exhaustions; or still more rarely by (c) cramps and fatal tetanic convulsions.

Death in a few cases occurs before the end of the second day and before jaundice has set in. Usually death takes place within a week. In one case the patient survived eight months. A little over one-ninth of a grain has caused death. Three-quarters of a grain to two grains may be looked on as an ordinary fatal dose, recovery, however, has been recorded after swallowing five grains.

Phosphorus vapour.—One or two acute cases of poisoning by phosphorus vapour are on record, but as a rule this form of poisoning is chronic in character. The chief symptoms present in chronic cases are caries of the teeth, and painful necrosis of the jaws, 'phossy-jaw,' most commonly of the lower jaw, followed in many cases by death from debility. Cases of this form of poisoning have chiefly been observed in workers in phosphorus, especially lucifer match makers: hence the term 'lucifer

for yellow phosphorus, cases of this form of poisoning are now much less frequent than formerly.

Post mortem signs.—In acute cases fatty degeneration of the liver is always, or almost always, present, and has been found far advanced in a case where death occurred in twenty-four hours. The phosphorus liver, except that as a rule it is enlarged and not diminished in size, resembles to the naked eye the liver of acute yellow atrophy. Fatty degeneration also may be present, of the muscular fibres of the heart, of the kidneys and of the epithelial cells of the intestinal mucous membrane. Spots of extravasation are often present under the serous and mucous membranes, and in other tissues. The skin may be yellow and the stomach contents phosphorescent. Signs of inflammation of the mucous membrane of the alimentary canal are not commonly present. In exceptional cases the *post*

as these dissolve phosphorus. Turpentine, in 40-minim doses often repeated, is recommended as an antidote. **Detection.**—

Phosphorus readily undergoes oxidation in the body, hence after death analysis may fail to detect its presence. Solid yellow phosphorus is easily recognized by its physical character. If present in organic mixtures in considerable quantity, it may be separated as a sediment by washing, afterwards melting it, if finely divided, under warm water; or it may be extracted from organic matters by carbon disulphide, in which it is soluble. If present only in small quantity, one of three processes may be employed, viz. (1) Mitscherlich's. Acidulate the matters with H_2SO_4 and distil them to dryness in the dark, using a well-cooled glass condensing-tube, which will show luminosity of phosphorus to be present. (2) A modification of Marsh's process, by which phosphorus, if present, becomes converted into gaseous hydrogen phosphide (PH_3), which burns with an emerald-green flame, and produces a black precipitate in silver nitrate solution, the liquid, after removal of the excess of silver, showing the presence of free phosphoric acid. (3) Lipowitz's method. Acidulate the matters with H_2SO_4 , and boil fragments of sulphur in them for an hour; remove and wash the fragments of sulphur, which, if phosphorus is present, will be found to have become luminous in the dark, owing to the deposition of phosphorus upon them. Phosphorus boiled with HNO_3 becomes converted into phosphoric acid, the presence of which may be recognized by precipitation with a mixture of ammonia, ammonium chlorido, and magnesium sulphate solutions. In this way, also, its quantity may be estimated.

Chlorine, Bromine, and Iodine.

(Chlorine

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time to a certain extent habituated to its presence. The
ing-compounds, *e.g.* chlorine
, also act as irritant poisons.
hydrogen sulphido; this,
however, must be employed with caution, as hydrogen sulphido
is in itself highly poisonous.

Bromine.—This in the liquid form is a corrosive poison. In the form of vapour its effects are similar to those produced by chlorine. One case of death in seven hours from an ounce of liquid bromine is recorded. Bromido of potassium in single doses has been known to give rise to symptoms of poisoning.

In large doses taken for a considerable time, it causes impairment of the functions of the brain and spinal cord, such as diminished activity of reflex action, cloudiness of intellect, impairment of memory and of articulation, and tendency to stupor.

Iodine.—Free iodine is a corrosive irritant; in poisoning by it the vomited matters are often blue or black owing to its action on starch. Twenty grains has caused death, but recovery is recorded from $1\frac{1}{2}$ drachms. Iodine in small doses, often repeated, is liable to give rise to chronic poisoning, the chief symptoms of which are, irritability of the stomach, vomiting, and purging, accompanied by salivation and wasting of the body generally, and specially of the breasts or testicles. Iodide of potassium has frequently been given medicinally in comparatively large doses (100 grains or more a day) without producing ill effects. Sometimes, however, small doses, often repeated, give rise to symptoms resembling those of severe catarrh, and in exceptional cases such symptoms have even arisen from single small doses. In exceptional cases also the ordinary symptoms of catarrh have been accompanied by somewhat severe symptoms of irritant poisoning.

Sulphur dioxide, commonly called Sulphurous Acid. This gas, like nitrous acid, acts as an irritant to the air-passages. From Woodman and Tidy's experiments it appears that when the quantity is small, animals soon get accustomed to its presence, and thereafter do not suffer nearly so much from its irritant action.

Nitrous Acid.

The vapours of nitric acid and the red gas evolved during the oxidation of matters by nitric acid,¹ are highly poisonous, giving rise when inhaled to inflammation of the air-passages and lungs. A few cases of death from the inhalation of such vapours are on record. In some of these the fatal result has followed on exposure for a few minutes to the vapours arising from a quantity of nitric acid, accidentally spilled by the

theless occurring rapidly (within ten to fifteen hours).

¹ Nitrogen peroxide (NO_2) and nitrous anhydride (N_2O_3); the latter, by combination with water, yields nitrous acid (HNO_2).

Oxalic Acid.

Oxalic and acetic acids may be conveniently considered here.—

Poisoning by oxalic acid is rare in India, but tolerably frequent in Europe. In England, in the five years ending 1880, seventy-four deaths from oxalic acid were registered, of which sixty-five (about seven-eighths) were suicidal, and the rest accidental. I have met with but four fatal cases in Bombay in twenty years. Of these three were suicidal, and the fourth apparently homicidal. Many accidental cases owe their origin to the resemblance in appearance of oxalic acid to sulphate of magnesia. Homicidal cases (probably owing to the strongly acid taste of the poison) are rare. Oxalic acid and the acid alkaline oxalates are chiefly used in the arts for cleansing purposes, *e.g.* cleansing leather, wooden boards, etc., and removing ink stains and iron moulds from linen.

Symptoms.—Oxalic acid and the acid alkaline oxalates

to the degree of concentration of the poison. Swallowed in concentrated solution, the symptoms due to the local action of the poison are immediate burning pain in the mouth and throat, with sense of constriction, followed rapidly by pain in the abdomen, and vomiting of matters containing altered blood. The interior of the mouth has a bleached white appearance; and if the patient lives long enough the stools containing blood. Swallowed in

due to local action are those of ————

There is an acid taste, but no burning pain, in the mouth; and vomiting does not come on for fifteen or twenty minutes: in one case it did not come on for seven hours. Remote action.—The symptoms due to this are twitchings of the muscles, in some cases amounting to tetanic convulsions; numbness, tingling and cramp in the limbs, great depression of the heart's action; slow spasmodic respiration; collapse, and stupor or insensibility, and sometimes delirium. These symptoms may be unaccompanied, or almost unaccompanied, by vomiting, pain, and other symptoms of local action. After-symptoms.—In cases of recovery, loss of voice has been observed, in one case complete for eight days, in another partial for more than a month. Alteration of the voice is sometimes present in acute cases. Numbness and tingling of the limbs and twitchings of the muscles may remain for some time after the first effects of the poison have disappeared. So also may irritability of the stomach; and as in other cases

of corrosive poisoning, death may occur after a considerable interval, from starvation.

Fatal dose, about half an ounce; cases, however, are reported of death from one drachm (in a boy aged 16), and three drachms (in a female aged 28), death taking place in respectively twenty-one hours and one hour. Cases of recovery after swallowing an ounce or more are reported.

Fatal period.—Exceptionally short, usually under one hour. Death has occurred in three minutes, in ten minutes, and in one case, not until the fourteenth day, from starvation. Woodman and Tidy mention a case where a man is reported to have walked ten miles after swallowing an ounce of oxalic acid.

Post mortem signs.—These vary according to the degree of concentration of the poison and rapidity of death. If the poison has been swallowed in a tolerably concentrated form, the lining membrane of the mouth, throat, and gullet is found white, shrivelled, and easily detached. If death has been rapid, the mucous membrane of the stomach may be pale, but usually is deep red, in places black, and may be found eroded. Perforation is rare. The stomach has been found so soft as to tear easily. The intestines may be found inflamed, and the lungs are often congested. Congestion of the brain has been found; and in one case, probably from violent vomiting, apoplectic effusion was present.

Treatment.—Administration of saccharated solution of lime, or of chalk suspended in water. Magnesia or carbonate of magnesia may be given instead of chalk. After administration of antidotes, warm water may be given freely. Vomiting should be promoted. Alkalies are inadmissible, and the stomach-pump should not be used if much corrosion be present, and, if used, should be introduced with great caution.

Oxalates.—Two acid potassium oxalates are in common use in the arts, viz. the binoxalate and the quadroxalate. Both are sold under the names of "salt of sorrel," and "essential salt of lemons," and both are nearly as poisonous as oxalic acid. The binoxalate has caused death in eight minutes. Half an ounce of it has proved fatal, but recovery is recorded from one ounce. Several deaths have occurred by eating the stalks of rhubarb boiled. The symptoms, treatment, etc., are precisely the same as in poisoning by oxalic acid. **Detection.**—Alkaline oxalates are found in many plants, e.g. in wood sorrel, and in its Indian substitute *Rumex vesicarius* (*Chula*); and also that oxalate of lime is found in many plants.¹ In cases, therefore, of alleged

¹ E.g. in rhubarb root and squills. See also *Drums*.

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Symptoms.—Oxalic acid and the acid alkaline oxalates possess both a local and a remote action. Of these, the remote action is much the more serious, and is usually the cause of death. Local action.—This is corrosive or irritant in character according to the degree of concentration of the poison. Swallowed in concentrated solution, the symptoms due to the local action of the poison are immediate burning pain in the mouth and throat, with sense of constriction, followed rapidly by pain in the abdomen, and vomiting of matters containing altered blood. The interior of the mouth has a bleached white appearance; and if the patient lives long enough, purging sets in, the stools containing blood. Swallowed in dilute solution, the symptoms due to local action are those of non-corrosive irritant-poisoning. There is an acid taste, but no burning pain, in the mouth; and vomiting does not come on for fifteen or twenty minutes: in one case it did not come on for seven hours. Remote action.—The symptoms due to this are twitchings of the muscles, in some numbness, tingling and
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¹ E.g. in rhubarb root and squills. See also *Annals*.

poisoning by oxalic acid or an oxalate, the *post mortem* appearances are, and the determination of the quantity of poison may be, of great importance. Oxalic acid is entirely dissipated by heat. In solution it yields: (1) With nitrate of silver a white precipitate insoluble in hot acetic acid, but slowly soluble in cold, and which, when collected, dried, and heated, is converted into metallic silver with a slight explosion. (2) A white precipitate with sulphur of lime solution, insoluble in acetic acid, which,

and precipitating the filtrate with acetate of lead; subsequently decomposing the oxalate of lead by suspending it in water, and subjecting it to the action of a current of hydrogen sulphide. Insoluble oxalates should be first decomposed by boiling with solution of caustic potash.

Acetic acid, tartaric acid, and citric acid.—Acetic acid acts as a corrosive if concentrated, but as an irritant when dilute, one fatal case is recorded in a girl, *æt.* nineteen, and another in a child aged two. Vinegar contains about 5 per cent. of this acid, and might possibly, in large doses, act as a poison. Acetic acid may be separated from organic mixtures by distillation and recognized (1) by the odour, and (2) by boiling with sulphuric acid and alcohol, when a peculiar aromatic smelling vapour (acetic ether) is evolved. Tartaric acid and citric acid in large doses act as irritant poisons; one ounce of tartaric acid has caused the death of an adult, and one fatal case, also in an adult, from four or five tablespoonfuls of cream of tartar (potassium bitartrate) is on record. Citric acid is believed to be more poisonous than tartaric acid.

Salicylic Acid Poisoning.

A case of poisoning by salicylic acid was reported from Cooch Behar. The deceased, after taking his evening meal, vomited, had several loose stools and died. The *post mortem* examination revealed . . . membrane of the stomach and mucous membrane of the small intestine and they contained blood. There was enlargement of the liver and kidney were forwarded to this department for examination and salicylic acid was detected in them.—Ch. Bose, *Beng. Chem. Ex. Rpt.*, 1910.

CHAPTER XXV.

METALLIC IRRITANTS.

Arsenic.

ARSENIC is the favourite poison employed by murderers in India, as in Europe, just as opium is the favourite of suicides. It is fortunate for the ends of justice that it is so, as the most infinitesimal traces of this poison can be detected with such absolute certainty and ease that there is almost no possibility of its escaping detection, if suspicion be once aroused. But it frequently happens that when the amount administered is not sufficient to cause violent irritation, the murder passes undetected, and not until the administerer enfolded by success develops a lust of murder is suspicion aroused by the number of his or her victims.

Its comparative tastelessness, the minute quantity of the dose necessary to destroy life, the readiness with which it can be procured in any bazaar, and the resemblance of its symptoms to those of the natural endemic disease—cholera—all render it an easy and effective agent in the hands of the subtle poisoner.

...ers, who lived in the time

...enical poisoning by giving

... . She afterwards poisoned

... an at the beginning of the

eighteenth century poisoned more than 600 persons, while a third in

Homicidal poisoning by arsenic is declining to some extent owing to the restrictions imposed on the sale of poisons and the publicity in the newspapers of murder cases. Such publicity gives a person of criminal tendency a wholesale fear of detection and a sense of insecurity in the face of the growing science of toxicology.

It is less commonly used for suicide.

Action.—Arsenical compounds act (*a*) locally as irritants, and (*b*) remotely on the nervous system; hence in cases of arsenical poisoning there may be present: (1) Irritant symptoms; and (2) Nervous symptoms.

1. Irritant symptoms.—Arsenical compounds act as irritants to the mucous membrane of the stomach and intestines, exerting this action even when introduced into the system by channels other than the mouth, *e.g.* even when absorbed through a wound. They also exert an irritant action on the various emunctories.

Hence in cases of arsenical poisoning there may be present: (*a*) The usual symptoms of irritant poisoning (unaccompanied, however, by any metallic or acid taste in the mouth), namely, epigastric and abdominal pain, thirst, vomiting, tenesmus, purging, etc., and even perforation of stomach, with presence of blood in the vomit and stools; and (*b*) symptoms due to the irritant action of the poison on the skin, kidneys, liver, etc., such as conjunctivitis, painful cutaneous eruptions and desquamation of the cuticle, salivation, dysuria, suppression of urine leading to uræmic coma, and jaundice.

2. Nervous symptoms.—The symptoms resulting from the remote action of arsenical compounds on the nervous system vary greatly in different cases. Thus there may be: (*a*) Collapse, with coldness of the surface and feeble pulse; or (*b*) Numbness and tingling of the extremities, cramps, and even paralysis; or (*c*) Convulsions, choreic, epileptiform, or tetanic, and lock-jaw; or (*d*) Delirium, and acute mania; or (*e*) Headache, drowsiness, and stupor, deepening into coma; and irritant symptoms may be inconspicuous.

Types of Arsenical Poisoning.

Cases of arsenical poisoning fall into three types, namely, (1) *Irritant*, (2) *Narcotico-Irritant*, and (3) *Narcotic*. In the great majority of acute cases, well-marked and severe irritant symptoms are present. Such cases either (*a*) prove rapidly fatal—say within twenty-four hours—by collapse; or (*b*) the usual symptoms of irritant poisoning are followed by various nervous symptoms, the patient either recovering or dying in one or other of a variety of modes; from exhaustion, or by coma, or in tetanic convulsions. In some of these irritant cases, remissions, or even intermissions, of the irritant symptoms, have been observed. In a few acute cases, irritant symptoms may be absent (see *Case*, p. 476) or slight (*Cases*, p. 476 (1-5)).

and the *nervous symptoms* well marked (see *Cases*, p. 476 (1st para.)); such cases usually prove rapidly fatal either by collapse or by coma.

Case (a).—Irritant arsenic poisoning—Large dose.—The victim, a native Christian missionary of Calcutta, was believed to have been poisoned by his wife and her paramour. Deceased was seized with violent vomiting and purging and died in a few hours. The wife reported the death to have taken place from cholera, but the police, on suspicion, had the body

Waddell, *Beng Chem. Ex. Rept.*, 1897

some days at a hotel as the wife of another man. About April 12-19th, 1889, Mrs. M. purchased arsenical fly-papers. On April 13-20th, Mr. May-

became sick, numbed, and in pain, and had cramps. About this date fly-papers were found by the servants soaking in Mrs. M.'s room, in a sponge-basin carefully covered up. On the 29th she again purchased two dozen fly-papers from another druggist. On 1st and 2nd May, Mr. M. went to his office and had his lunch sent to him by Mrs. M., and in one of the jugs, found at the office after his death, arsenic was found. On the evening of the 3rd May he was seen by Dr. Humphreys and complained of being sick from his revelentia food, and had persistent vomiting and coughing and tingling in throat on the 4th and 5th. The vomiting lessened on the 6th, and Fowler's solution was ordered, but only a quantity equal to 3½ grain was actually taken. On May 7th the throat was red, dry and glazed, and diarrhoea commenced, and the result of a consultation was that Mr. M. must have taken some irritant in his food or drink. On 8th and 9th severe tenesmus setting in with bloody diarrhoea, Dr. Humphreys suspected arsenic and examined the urine and made a rough analysis of some Neave's food the patient had been taking. The patient died on the 10th. The *post mortem* showed signs of irritant poisoning, and an ulcer of epiglottis (caused by the lodging of a speck of arsenic); but no arsenic was found in the stomach or its contents or in the spleen. Arsenic was found in the liver, intestines and in the kidneys. The quantity separated

weighed 48 ozs., and from 12 ozs.

oned as As_2O_3 was separated.

death were:—On the night of

to remove from the table an

opened bottle of meat juice and take it to an inner room and then replace it surreptitiously. In replacing it she was observed to take it from the pocket of an inner jacket. The lining of this pocket was found to be impregnated with As_2O_3 , and the juice contained 0.5 grain As_2O_3 . The following things contained arsenic:—Mrs. M.'s dressing gown, her apron, and handkerchief wrapped round a bottle, a portion of a handkerchief,

Price's glycerine, medicine purporting to be that prescribed by Dr Fuller, three bottles of saturated solution of arsenious acid, lavatory drain. Mrs. Maybrick was convicted and sentence commuted to penal servitude for life.—T. Stevenson, *M.D., Guy's Hosp. Rept.*, 1889.

It was reported
gery. It died
that "the eyes

Over thirty-
two grains of white arsenic were found in the stomach.—*Mad. Chem. Ex. Rept.*, 1898. (2) In a suicidal case, suspected to be opium poisoning on account of the narcotic symptoms, arsenic was found in very large quantity and no trace of opium. The man died in about eight hours without vomiting or purging. The pupils were contracted to pin points.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 9. (3) A convict compounder in Port Blair in 1906 was found unconscious and groaning and having violent cramps.

Ex. Rept., 1907.

of
arsenic

although the usual *post mortem* signs were found.

admission, and died 4½ hours after taking the poison.—C. Robertson-Milne, *Ind. Med. Gaz.*, 1902, p. 209.

Case (f).—Irritant symptoms slight.—Of 303 fatal cases reported to the Bombay Chemical Analyser's Office during the ten years ending 1884 six (and no other cases).

no purging, there was also
intestines. In the other
there was one patch of red
post mortem appearances of it
cases. The symptoms re
the abdomen and thirst,
into hospital, none after
admission into hospital.
only, and had no purging.
to be tremendously injected
men, no vomiting, and no
at the bed-clothes, and incontinence, no vomiting and no purging. *Case*

(4) and (5), although under medical observation, were not, during life, recognized as cases of poisoning. In case (4) only one and a half grains of arsenious oxide was found in the contents of the stomach. In case (6) the quantity found was one hundred grains. In the other four cases, the quantity found ranged from nine to fifteen grains. K. M. (*Beng. M. R.* for 1868-69) mentions a case where a girl, *æ.t.* seven, died in three hours, neither vomiting nor purging being present. Similar cases are recorded by various authors. Christison (*Poisons*, pp 308 *et seq.*, 1845) gives fourteen cases, all fatal within twelve hours, in which only slight irritant symptoms were present. In five of the fourteen, *post mortem* appearances of irritation were either altogether absent or trifling only.

In chronic cases both irritant and nervous symptoms are usually present. Sometimes in chronic cases the amount of gastric irritation is slight, while the irritant action of the poison on the skin, causing skin eruptions with pigmentation, bronchitis, etc., bronchial tubes and emunctories other than the intestines, is well marked. In chronic cases, the nervous symptoms frequently take the form of numbness and tingling of the extremities, and paralysis peripheral neuritis. This last effect has occurred in epidemic form amongst beer drinkers through contamination of arsenic in the beer. These cases show that arsenic is culminative. The sequence of symptoms in chronic poisoning is (1) digestive, (2) laryngeal catarrh, bronchitis and skin affections, (3) disturbance of sensibility, (4) motor paralysis with pigmentation and keratosis.

Diagnosis from disease.—Acute irritant cases with collapse greatly resemble cholera, and may be mistaken for it by medical men well acquainted with cholera, see *Case*, p. 478, and in India a common way of attempting to conceal homicidal poisoning by arsenic is to report the case as one of death from this disease. Sometimes also, especially in cases where two or more persons after partaking of food in company are attacked by cholera in quick succession, a groundless suspicion of arsenical poisoning arises. The chief points which distinguish arsenical poisoning from cholera are: (1) The presence in the former of blood in the stools; (2) The absence in the former of the rice-water appearance of the stools, characteristic of cholera (this appearance may, however, be present in the later stages of arsenical poisoning); and (3) In cholera, pain in the throat does not precede vomiting, while in irritant poisoning the reverse is the case. The prevalence or absence of cholera in the locality at the time may also serve as an aid to the diagnosis. Cases where the irritant symptoms are slight are sometimes not recognized during life as cases of poisoning.

In chronic cases persistent gastric irritation not yielding to treatment, accompanied by numbness and tingling of the

extremities, with tendency to paralysis, should arouse suspicion, and indicate the necessity of subjecting the urine or other evacuations to analysis. It may be mistaken for Addison's disease and beriberi.

glass phial was found, in which a large quantity of white arsenic, in powder, was detected, mixed with sugar and rose-water, which were

L. A. Waddell, *Beng.*
 Jessore in 1906 with
 certain information sent the viscera for examination, and arsenic was
 detected in them.—C. L. Bose, *Beng. Chem. Ex Rept.*, 1907.

Interval between swallowing the poison and first appearance of symptoms.—This is usually half an hour to an hour. Cases, however, have been reported where the symptoms appeared almost immediately. Taylor¹ mentions a case where the symptoms came on while a man was in the act of eating a cake containing the poison. I once met with a case where the symptoms appeared while a man was drinking a cup of tea made with water from a kettle into which arsenious oxide had been introduced. On the other hand, a few cases are reported in which this interval has been delayed to two, to eight or nine hours. In some of these cases the prolongation of the interval is difficult to account for; in others it appears

¹ Taylor, *Poisons*, p. 292.

to have been due to fulness of the stomach, to sleep, or to intoxication (see *Cases* below), and occasionally there are almost no symptoms (p. 176).

Cases.—**Arsenical poisoning; delayed symptoms.**—(a) (Christison on *Poisons*, p. 239). A man took seven drachms of arsenious oxide at eight in the evening, went to bed at half past nine, and slept till eleven, when he awoke with slight pain in the stomach, vomiting, and cold sweats—he died in nine hours.—(b) (*Heng M. R.* for 1870-72). Five persons,

four all adults the symptoms appeared in about an hour. Two of the adults had not supped previous to eating the sweetmeat—both these died. The other three individuals had just finished their evening meal, and all three recovered.—(c) (Woodman and Tidy, *For. Med.*, p. 163). A female took $\frac{1}{2}$ oz. of arsenious oxide after a meal. No symptoms appeared for eight hours, when pain, vomiting, and purging set in; the stomach-pump was used. Result, recovery.—(d) (Christison on *Poisons*, p. 308, one of the fourteen cases referred to under 9). "The subject was a man so addicted to drinking, that his daily allowance was a pint of brandy. When first seen, there was so much tranquillity, that doubts were entertained whether arsenic had really been swallowed, but at length he was discovered actually chewing it. This state continued for nearly five hours, when some vomiting ensued. Coldness of the extremities and spasmodic flexion of the legs soon followed; and in a few minutes more he expired."—(e) (*Id.*, p. 309). A man swallowed three drachms of arsenious oxide, then went about for two hours, bidding adieu to his friends; he was then persuaded to take emetics, which caused free and easy vomiting; he hardly suffered at all for five hours, but died nine hours after taking the poison.

Fatal period.—In acute cases this is usually under twenty-four hours. In many cases, especially those in which marked nervous symptoms appear early, death takes place in under twelve to fourteen hours. In one case a young man died with tetanic symptoms in twenty minutes;¹ this is the shortest fatal period recorded. Longer fatal periods than three days are sometimes met with. Taylor² mentions cases of death in six days, seven days, fifteen days, and sixteen days. In one case (a woman accidentally poisoned by external application of a solution of arsenic), death did not occur for two years.

Post mortem signs.—Gastric mucous membrane is usually reddened from inflammatory action, and has been found so even where the poison has been introduced by channels other than the mouth. It has been found intensely inflamed even when death has taken place within two hours after swallowing the poison. It may be reddened in patches, or

¹ Taylor, *Poisons*, p. 309.

² *Ibid.*, pp. 27, 309.

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absence of irritant signs in the alimentary canal. L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899. (3) A woman died in Jessore in 1906 with vomiting and purging which was reported as cholera, but the police on certain information sent the viscera for examination, and arsenic was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

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eight hours, when pain, vomiting, and purging set in; the stomach pump was used. Result, recovery.—(d) (Christison on *Poisons*, p. 303, one of

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¹ Taylor, *Poisons*, p. 303.

² *Ibid.*, pp. 27, 309.

the redness or hæmorrhages may be punctiform or striated in appearance, or the whole mucous membrane may be deep red, with dark petechi or ecchymosed spots from underlying extravasated blood. Frequently the inner surface of the stomach has a corrugated appearance, and is covered with tenacious mucus entangling particles of the poison, if the latter was given in solid form. Its contents are often dark in colour from altered blood. When arsenic is given as a powder, sometimes minute specks or patches of whitish or yellow powder (due to conversion of the white arsenic into yellow sulphide) are formed embedded on the surface of the mucous membrane of the stomach or intestines, and each speck may be the centre of inflammatory patch. The redness and patches sometimes extend into the duodenum; more rarely the intestines are found inflamed throughout their whole length. Commonly the rectum is found inflamed. Ulceration of the gastric mucous membrane is not common, but has been found in case of death in ten hours. Perforation of the stomach is very rare, but is occasionally found (see *Case* below). Sometimes in fatal cases the stomach and intestines show little or no signs of inflammatory action; this has been observed even in a case where well-marked irritant symptoms were present during life. Hæmorrhage beneath the endocardium, especially of the left ventricle, in the form of dotted petechiæ or in larger patches is extremely characteristic, and has been found by Gibbons and Powell in forty-three of sixty cases of acute poisoning. *This is a very valuable sign.*

the heart¹ was
Congestion of

Arsenic exerts a marked antiseptic action on the tissues, and hence, in fatal cases, *post mortem* appearances of gastric irritation may remain recognizable for a considerable period. *Post mortem* appearances indicative of death from arsenical poisoning have been found coupled with *post mortem* appearances pointing to death from mechanical violence (see *Case*, p. 206); hanging (see *Case*, p. 207); and even in bodies found under circumstances which pointed to death by drowning.

Cases.—Perforation of the stomach in arsenical poisoning.—This was reported in two of the three hundred and five Bombay fatal cases. In a case reported by Dr. H. H. Batty; in this case a woman, æt. about

¹ *Medico-legal Dept.*, 1870-72, p. 255.

thirty five, after a quarrel with her husband, swallowed a quantity of arsenious oxide. Duration of case not stated. *Post mortem* appearances, much congestion of the membranes of the brain, also of the brain, lungs, kidneys.
 membrane of
 Stomach perforations
 perforations
 from the latter, a longropy mucous substance was protruding, in which there was a large quantity of minute white particles of arsenious oxide. Small intestines very red throughout, and containing particles of solid arsenious oxide.

Case—Arsenical poisoning—Absence of usual appearances of inflammation in the stomach and intestines—Christison, besides the five cases mentioned, gives two other cases in which, on *post mortem* examination, the mucous membrane of the stomach and intestines was found to be free from signs of inflammation (*I B.L.*), and I have met with one other case (out of three hundred and five), in which only trifling signs of inflammatory action were present. Harvey (*Beng. M. R.* for 1870-72) records absence of signs of inflammation in four cases out of one hundred and ninety-one. In one of these cases, the symptoms were "vomiting, purging, dryness of the mouth, thirst, anxiety, vertigo, and prostration." Death occurred in nine hours. In this case, the "whole of the intestinal tract" was found healthy.

Treatment.—(a) Elimination. This should be chiefly relied on. Vomiting should be encouraged, and copious draughts of warm water given, or better emetics, or the stomach-pump. Arsenic is rapidly voided by the urine. (b) Prevention of action by antidote. Hydrated ferric oxide should be given in considerable quantity. Thirty-two parts by weight of this antidote are required to render insoluble one part by weight of arsenic oxide. The antidote must be freshly prepared, as it loses its power if kept for any length of time. To prepare it, a quantity of a solution of a ferric salt, *e.g.* ferric chloride, should be either rubbed up in a mortar with magnesia, or precipitated by solution of ammonia; in the latter case the precipitate must be washed on a calico filter before administration. (c) Counteraction of effects. This indication must be carried out on general principles. Demulcents should be given to allay irritation, and other symptoms treated as they arise.

Fatal dose.—The smallest fatal dose for an adult hitherto recorded is under two grains of Arsenious Oxide. It was the case of a woman who took half an ounce of Fowler's Solution (Arsenite of Potassium) during a period of five days in unknown doses, and she died by syncope without vomiting or purging, but the stomach and intestines were inflamed (Castle, *Prov. Jour.*, 1848, 347). In another case two and a half grains of Arsenious Oxide contained in two ounces of 'fly-paper' killed a robust healthy girl, aged nineteen, in thirty-six hours (Taylor, *II.*, 482)

Hence under circumstances favourable to the action of the poison, the fatal dose for an adult may be estimated at two to three grains of arsenious oxide. Cases of recovery under free vomiting are recorded from doses of one to two ounces of arsenious oxide. In one very exceptional case of recovery from a large dose (*Case below*) the poison swallowed—two masses of arsenious o

anum. Pe

daily may

as much as four to six grains of arsenious oxide without experiencing symptoms of poisoning. This habit of 'arsenic eating' is practised by the peasants of Styria under the belief that it improves the skin and increases the respiratory powers; the same habit prevails to a certain extent in the Panjab, arsenic being there eaten either as an alternative to opium eating, or as an aphrodisiac.¹

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3 of arsenic
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p. 183. *Ind. Med. Gaz.*, 1872,

Forms of Arsenic used as poisons in India.

These may be: (1) White Arsenic or Arsenious Oxide, (2) Arsenite of Potassium or Sodium, (3) Copper compounds—pigments, (4) Arsenic Acid, (5) Sulphides, (6) Chlorides, (7) Arseniuretted Hydrogen, (8) Cacodylates of Arsenic as anti-syphilide remedies.

In the great majority of cases arsenious oxide is employed; in a few the sulphides (orpiment and realgar) are used, either alone, or mixed with arsenious oxide, and exceptionally the arsenites of copper.

ARSENIOUS OXIDE.

Common white arsenic is known in the vernacular as *Sanlhyā*.¹ *Phathya somul*, or *Somul khar*. This is yearly imported in large quantity, chiefly from the Persian Gulf, and

¹ *Med. Jur.*, p. 117. Or the 'conch shell,' from the vitreous lustre of the lumps of crude arsenic.

is readily purchasable all over India. The chief legitimate uses to which it is put in India appear to be as follows —

(1) As a preservative agent, especially for wood. Chevers mentions that with this object it is thrown into the holds of vessels, and placed round wooden foundation piles, and applied to the woodwork and walls of

and other diseases, and externally as a parasiticide and depilatory, especially among prostitutes, and as a healing ointment for sores in horses and cattle. It has already been mentioned that it is used to a certain extent in the Panjab, as an alternative to opium eating, and as an aphrodisiac.

Homicidal use.—Of all poisons arsenious oxide is the one by far the most frequently employed in India for homicidal purposes. When so employed, the vehicle is most commonly sweetmeat or bread or other food.

Sweetmeat, poisoned with arsenic, often consists of but little more than sugar or '*gur*' (coarse sugar), and coarsely pounded arsenious oxide. Often a club or stick and a piece of flat board, or a couple of stones, are used for pounding the arsenic, and particles of the poison are found adhering to them. When bread is the vehicle used, the coarsely pounded arsenious oxide is often simply placed between two layers of or mixed with the dough. Sometimes, however, it is ground up with the flour,

to have particles of the poison
 sees it is the person grinding the
 in others, the poison is put into
 the handmill by another during the temporary absence of the person using it. Sometimes the vehicle is cooked vegetable food, *eg.* cooked rice, pulse, etc.; also, in cases of alleged poisoning, arsenious oxide is found in sweet oil, in tamarinds, in *chuna* (lime) used with betel nut for chewing, and in one case it was found mixed with realgar in a '*huri*' or native cigarette.

Very often the quantity of the poison added to the food in a homicidal

more than
 arsenious

several grains (*Case*, p. 505). Arsenious oxide, when used for homicidal purposes, is generally used alone. It is, however, found sometimes in food with the sulphides of arsenic, with sulphate of copper, with mercuric sulphide, with sulphate of iron, and with pounded glass; and in the Baroda case (p. 486) it was found mixed with diamond dust. Frequently in one and the same case several persons are poisoned.

The motives in India most commonly leading to homicidal poisoning by arsenious oxide appear to be revenge and sexual passion.

Common types of the crime are (1) A, at enmity with B, gives him (see *Case* below) or his children (see *Cases*, p. 485) some poisoned sweetmeat, or introduces arsenious oxide into his food; of which often others as well as B partake. As a result a number of persons, often the members of one family, children as well as adults, are poisoned (see *Cases* (d) and (e), p. 485); or (2) a wife, being anxious to get rid of her husband, puts arsenious oxide—often supplied by a paramour—into her husband's food. In some cases where husbands are poisoned by their wives, the motive is not homicidal, but connected with the belief in the *aphrodisiac* virtues of arsenic before referred to. Thus in a case where a woman confessed to having put a white powder (afterwards found to be arsenious oxide) into her husband's food, she alleged that the powder was given to her as a charm, or medicine, 'to increase her husband's love for her.' In *Case* (a), p. 486, this belief also may have led to the administration of the poison. *Case* (b), p. 486, is a curious example of a poison, prepared for a particular individual, going astray and poisoning others. It is seldom that in India acquisition of money or property forms the motive for arsenical poisoning. When *theft* is the object, *datura* (which see) is the poison usually employed. One or two cases of road robbery in which arsenious oxide was the poison used have, however, been reported. In exceptional cases also superstition leads more or less directly to arsenical poisoning (see *Case* (c), p. 487).

It should be borne in mind that the ease with which arsenious oxide can be obtained in India, and the difficulty of tracing its purchase, tends not only to increase the frequency of its use for homicidal purposes, but also to facilitate the fabrication of false charges of attempted poisoning by surreptitious introduction of arsenic into exhibits. Again also, it must be recollected that an individual, while in custody,

¹ *Benj. Medico-legal Rept.*, for 1870-2 states that of 203 cases of poisoning by arsenious acid occurring in Bengal, N.W. Provinces, Oudh and the Punjab during the three years,
 ninety-seven cases of arsenic
 Madras, in the two years

may from fear make a false confession of poisoning. In *Case*, p. 487, there is little doubt but that such a false confession was made.

(a) **Arsenical poisoning.** Sweetmeat, etc., containing arsenious oxide in large proportion.—(a) (*Bo. Chem. Analyser's Rept.*, 1872-73). In a case tried before the High Court, Bombay, it was proved that a man went up to another, a police sepoy, while standing on duty in the public streets, and offered him some sweetmeat. He took it, bit off a mouthful, but finding it to have a gritty taste, spat it out. From eight hundred and sixty grains of the remainder, I extracted six hundred and ten grains of arsenious oxide. The police sepoy, it was stated, had run away with the wife of the man who attempted to poison him.—(b) (*Rept.*, 1874-75). In a case from Ahmednagar, in which a man died in twelve hours after eating some poisoned bread, 5½ lbs. of the bread were found to contain one thousand five hundred and six grains of arsenious oxide.

(c) (*Rept.*, 1878-79). In a case from Ahmednagar, in which a man died in twelve hours and six, a portion of the sweetmeat was found in relatively large quantity in an unconsumed portion of the sweetmeat. The motive in this case was stated to be a quarrel with the parents of the children.—(d) (*Rept.*, 1882-83). Five persons, two adults and three children, inmates of a leper hospital in

The motive in this case, it was stated, was to get rid of a leper husband, whose wife the accused wanted to marry.

Cases—Arsenical poisoning. Homicidal multiple cases (*Bo. Chem. Analyser's Rept.*, 1880-81).—(a) In a case from Uran, a man and his wife and two children were all four poisoned by arsenious oxide contained in bread, given to them, it was alleged, by a neighbour who had a quarrel with the family. Two of the four died.—(b) In a case from Hyderabad (Sind), three persons were poisoned. One of the fingers of the persons, one of

food. In this case the accused was, it was said, on bad terms with the persons poisoned, and was seen seated near some cooking-pots in which their food was being prepared, leaving just as they were about to commence their meal.—(d) (*Rept.* for 1879-80). In a case also from Ahmednagar, two children, both of whom died, and three adults were poisoned. In this case it was alleged that the aunt of the children was the poisoner. She was seen, whilst the food was being cooked, of which the persons poisoned afterwards partook, to throw something into the pot containing

(offering) of a goddess. The man to whom the sweetmeat was given,

Sayads,

quantity of sherbet, mad
sherbet was bad, and ha
away, but in the act of
sediment lying at the bottom of it. This sediment was proved, on analysis,

situation as to make it possible that it had resulted from contact with the arsenic.

Cases.—Arsenical poisoning; exceptional cases.—(a) (*Bo. Chem. Analyser's Rept.* for 1884). In a case tried before the High Court, Bombay, four men were charged with the murder of a young female, a dancing girl. The evidence went to show that one of the accused was

on his suit. The result was that a number of sweetmeat balls were

the only persons who suffered from symptoms of irritant poisoning.

and that there was no murderous intent.—(b) (*ib.* for 1878-79). The history of a case from Gulag, in which four persons—two children, who died, and two adults, who recovered—were poisoned by arsenious oxide, was thus given by the assistant-surgeon in charge of the dispensary:—"The mother of the deceased children obtained three small sweetmeat balls from one of her paramours, with the object of administering the same to a man named Dushrath Sonar, who was also in love with her. The man who prepared the balls, and gave them to the woman, states

that he mixed some kind of white powder with the balls. The powder was procured by him from a mendicant Byragi (Hindu ascetic), and the sweetmeat balls were made especially mixed with the powder to poison Dushirath

house —(c) (*ib.* for 1876-77) The history accompanying a case from Amraoti was as follows —“A man lost some ornaments, and suspected his sister of stealing them. Under the advice of a ‘wise man,’ he put outside

was that the sister died with symptoms of irritant poisoning, and one and a half grains of arsenious oxide were found in the contents of her stomach.

Case —Apparently false confession of arsenical poisoning. —In a case from Nasik a man died suddenly, and his brother accused deceased’s wife of poisoning him. The wife was taken into custody, the body disinterred

Bo Chem Analyser’s Rept., 1884.

of the stomach of an adult. The poison was administered in whisky

tered with solid food in some thick liquid. Another argument of the defence was that the arsenic purchased by Madeline was mixed with soot, while no soot was found in the stomach or intestine of the deceased —her quondam lover,—and a girl was unlikely to know how to remove the soot from the arsenic—verdict was ‘not proven.’ (b) and (c) Taylor (on

Agra Case.—Clark, an officer of the Subordinate Medical Department, was charged in 1912 with the murder of Mr. Fulham, whose medical attendant he was and with whose wife he had an intrigue. Poisoning

was suspected and evidence given that the prisoner had large quantities of *Gelsemium*. Chemical examination failed to detect any alkaloid, but traces of arsenic were found in the thigh bone. The accused was found guilty and suffered the death penalty.

Abortifacient use.—Arsenious oxide is sometimes given or taken with the object of causing abortion, usually with fatal results.¹

In one case, in Bombay in 1883, *post mortem* examination of a female four months advanced in pregnancy, disclosed a mass of paste containing arsenious oxide, lying in the upper part of the vagina near the os uteri.

Suicidal use.—Suicides by poison in India usually select opium; but a certain number use arsenious oxide. It would appear that in Bengal, N.-W. Provinces, Panjab, and Oudh, about one-third of the fatal cases of arsenical poisoning are suicidal, but that for one suicide by arsenic there are rather more than seventeen suicides by opium.² In Bombay also, about one-third of the fatal cases of arsenical poisoning reported to the chemical analyser's office appear to be suicidal; and these suicidal cases about equal one-tenth of the total number of suicides by poison shown in the mortality returns for the whole presidency. Sometimes, in suicidal cases, the quantity of arsenious oxide found after death in the contents of the stomach is very large.

Taylor³ refers to a case where the quantity found was four ounces. In one case of suicide, at Bombay, 360 grains were found, and several times, over 100 grains were found. The discovery in the contents of the stomach after death of a large quantity of arsenious oxide to a certain extent indicates the probability of suicide. It, however, by no means negatives homicide, especially in India, where very large quantities are given, or attempted to be given, in homicidal cases. In *Cases (a)–(c)*, p. 485, the quantity found was very large. *Case (a)*, p. 469, is still more conclusive on this point, the victim being an adult instead of a child. Taylor also mentions two other cases, both charges of homicide, in which the quantity found was large (see *Cases (b)* and *(c)*, p. 487).

Accidental cases.—Accidental poisoning from internal administration of arsenious oxide is sometimes met with, generally from the poison being mistaken for some inert mineral substance (see *Case*, p. 489) become by carelessness or accident mixed with articles of food. The possibility also that in some cases arsenious oxide is intentionally administered

¹ *Beng. Medico-legal Rept.*, 1870-72

² *Ibid.*

³ *Med. Jur.*, II., p. 270

without actual homicidal intent has already been alluded to (see *Case (a)*, p. 186).

External application of arsenious oxide also occasionally causes fatal poisoning (see *Case* below). In another case referred to above, in which death did not take place for two years, the poison was applied in solutions to the skin for the cure of itch, its application being followed by an erysipelatous eruption. *Cases (a)* and *(b)*, p. 490, are additional examples of this form of accidental poisoning. It may be here pointed out that the continued application of arsenious oxide to the unbroken skin, may cause an erysipelatous or eczematous eruption thereon. This may be followed by denudation of the epidermis, and sloughing and ulceration owing to the caustic action of the poison. The question as to what effect long-continued application of arsenious oxide has on the unbroken skin arose in the Baroda case (p. 486).

Case—Arsenical Poisoning by Puncture.—A Bengali had scrotal tumour, and had been suffering from rheumatic fever for about a week. A person named Satyabadi Mangraj, ostensibly in the endeavour to cure the man, punctured the tumour, and applied some irritant or poisonous drugs to it, from the effect of which the man died. The left testicle and portion of the scrotum of the deceased, which exhibited puncture marks, were forwarded here for examination, and arsenic was detected in them. —L. A. Waddell, *Beng Chem. Ex. Rept*, 1897.

A

through mistake. More than 200 persons were poisoned, of whom seventeen died.—(d) *In tea and coffee*—Mr. C—, a resident of Bow

and pain in the abdomen. The nephew and the cook suffered most severely, and were removed to the Medical College Hospital, where both of them died. The others recovered. The viscera of the cook was forwarded for

As to how the arsenic was introduced into the water kettle nothing could

mentally into the food is very great.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899—(f) As . . . :

14 years, who was in
administered to her
object of causing her

The civil surgeon finding some of the internal organs congested, the mucous membrane of the intestines slightly congested in parts, and containing about two ounces of rice-water stools, ascribed the death to cholera, and did not send the viscera for chemical examination. The police, however, sent the vomited matter for analysis, and arsenic was detected in this as well as in the sugar which had been given to her.—L. A. Waddell, *Beng Chem Ex. Rept.*, 1884, p. 9.

Cases.—Arsenical poisoning by External application.—(a) (Taylor, *Poisons*, p. 304). The mother of a girl, *et. nine*, rubbed some white
her child's head, in order

stomach and duodenum was found.—(b) (Taylor's *Manual*, p. 48, or Blyth, *Poisons*, p. 510). In 1876 a number of infants were poisoned in England by arsenious oxide contained as an adulterant in violet powder. Some of the powder was
one case, reported by M
newly-born infant, at 10
red, and ultimately in
child died on the 10th
herds were engaged in

arsenious oxide and solution of carbonate of potash. Both suffered on the fourth day after the dipping, had eczema of the scrotum, and vesicles on the thighs, slight fever, and great thirst. Dr. Watson, who reported this case, states that other shepherds, even when using As₂O₃, only, suffered from eruptions, chiefly on the hands, forearms, scrotum, and thighs.

Case—Arsenic poisoning by post.—In August, 1899, Mr. P—, P. W. D., Shwelo, Burma, received a postal package from Rangoon containing a bottle of beer. He opened it, and being apparently suspicious, showed it to his native servant, who took a teaspoonful, and shortly afterwards became desperately ill. The contents of the bottle on being examined showed that the beer was charged as full as possible with arsenic. About the same date Mr. Green, of the Telegraph Department, Bhamo, received from Rangoon by post a packet of cocoa. When he opened it he saw arsenic, and handed the packet to the police. The packet has now been analysed, and shows enough arsenic in one spoonful to kill half a dozen men.—*Englishman*, 18th August, 1899.

Cattle-poisoning by arsenious oxide.—A large number of horned cattle are yearly poisoned in India.¹ With very few exceptions the poison used is arsenious oxide. Thus, in Western India, arsenious oxide was found in 714 out of 743 cases of cattle poisoning, reported to the Bombay Chemical Analyser's office during the ten years ending 1885. Nearly always, where the animals killed are horned cattle, they are poisoned for the sake of their skins.² The usual plan adopted is to make some powdered arsenious oxide into a paste with oil, and insert a mass of this, often wrapped in paper, into a cavity scooped out of a head of jowari or other grain, or enclose it in a bundle of grass. In a few cases, the arsenious oxide is mixed with one or other of the following:

lass. Cases of

. The motive

against owner

of the animals. In one case of horse poisoning, occurring in Bombay, a native gentleman lost seventeen horses in three months. The bodies of the first fifteen were not examined, but the sixteenth and seventeenth were both found to have been poisoned by arsenious oxide. The symptoms caused in cattle by administration of arsenious oxide and other poisons are similar to those in human beings.

Form.—Arsenious oxide is met with in the form of (a) white masses looking somewhat like lumps of white earthenware; these are at first translucent, but become opaque by keeping; (b) A shaped fragment (a); and (c) A

¹ In 1884, 288
Examiners as killed
cattle, were killed

² By *Chamars*
(Pariahs), who claim the bodies of animals dying of disease
that he has found ordering the bodies to be buried in
shops cattle-poisoning in districts where this crime
p. 212

of minute crystals. Forms (a) and (b) are the forms in common use in India; form (c) is only occasionally met with.

The difference in appearance under the microscope of forms (b) and (c) was a matter of much importance in the *Case* overpage. Powdered arsenious oxide is usually met with in England coloured with soot or indigo, as directed under the Arsenic Act (14 Vic. cap. 13),¹ and in case of poisoning it may be of importance to note the nature of the colouring matter found mixed with the arsenious oxide.

Case—The De Ga Case.—In this case a number of the members of a Portuguese family of position, resident in Bombay, were poisoned by arsenic. The circumstances of the case were as follows: A man, believed to be a Hindoo, who afterwards disappeared and has never been traced, left at the family residence in Bombay a present of cakes. Some of these cakes were passed on to another house, where other members of the family resided, and these, in their turn, sent a portion to a third house. All who partook of the cakes suffered; three died. The cakes, on examination, were found to contain an interior layer of jam, mixed with a quantity of coarsely pounded arsenious oxide. In the course of the police inquiry into this case, suspicion arose that the poison had been abstracted from a particular druggist's shop in Bombay. It, however, turned out that the only arsenious oxide in this shop was a quantity submitted to

Properties.

Taste either absent or slightly roughish or sweetish; not strongly metallic, as is the case with many white irritant poisonous powders, or acid like oxalic acid. **Specific gravity**



FIG. 28—Sublimate of Arsenious Oxide Crystals $\times 100$

about 3.7. A pinch of powdered arsenious oxide weighs about 17 grains, a teaspoonful about 150 grains, and a tablespoonful about 530 grains.—Taylor. **Solubility.**—Cold water dissolves about half a grain to a grain per ounce. Boiling water dissolves more, and water boiled for an hour with it will take up

¹ Although the Sale of nearly twenty years, I can I found powdered arsenious mentioned in s. 17 of the Bombay Act.—I B. L. 1893

about 12 grains per ounce.¹ A much larger quantity of powdered arsenious oxide than this may, however, be suspended in mucilaginous fluids. When finely powdered arsenious oxide is mixed with water, a small quantity rises to the surface and floats thereon, forming a film. The fact that such a film was observed on a particular fluid supposed to have contained the poison administered, may be an important piece of evidence. Alkalies and alkaline carbonates, owing to the formation of alkaline arseuites, augment, and, according to Taylor, organic matter as a rule decreases, the solubility of the poison. Arsenious oxide is very soluble in hydrochloric acid. Effect of heat.—Solid arsenious oxide when heated volatilizes without charring or fusion. Its vapour, received on a moderately heated surface, condenses in minute crystals of characteristic appearance, the majority of which are more or less perfect octahedra (see Fig. 28).

Detection.—(1) By the effect of heat on the solid as stated above. (2) Boiled with water the solution of arsenious acid so obtained (a) acidulated with hydrochloric acid yields a yellow precipitate with hydrogen sulphide, soluble in solution of ammonia; (b) yields a yellow precipitate with ammonio-nitrate of silver;² (c) gives a green precipitate with ammonio-sulphate of copper;³ and (d) the solution (or the powdered solid), boiled with nitric acid and the fluid evaporated to dryness, yields a residuo of arsenic acid, which when dissolved in water gives a red-brown precipitate with solution of silver nitrate. (3) Powdered arsenious oxide mixed with powdered charcoal and powdered sodium carbonate,⁴ and heated in a narrow tube (the '*Reduction process*'), see Fig. 29, yields a sublimate of metallic arsenic as a ring, hair-brown in colour where the film is thin, and dark-grey or black and lustrous where thicker. Such a ring cut off and heated in a wide tube sublimes readily with formation of arsenious oxide, which condenses on the side of the wide tube in minute crystals of the characteristic appearance before noted. The wide tube should first



FIG. 29—(b) Sublimate of Metallic Arsenic, by the Reduction Process.

¹ Prepared from copper sulphate solution, in a similar way.

² Black flux.

be warmed above the metallic ring, as arsenious oxide is apt to condense on a cold surface as an amorphous powder. This 'reduction process' may be used for the identification of other solid dry arsenical compounds, other than white arsenic. For details of Reinsch's and Marsh's tests see pp. 503-5. For testing for arsenic in bones, see p. 506.

Sulphides of Arsenic.

Two of these are in common use in India, viz. the yellow sulphide, orpiment, King's yellow or *Hartal*, As_2S_3 , and the red sulphide, realgar, *Sandaracha* or *Mansil*, As_2S_2 . Both appear to be favourite medicines of the *hakims*, and to be in common use as depilatories; for this last purpose a mixture of orpiment and lime or carbonate of lime appears to be often employed. The yellow sulphide is largely used in India as a pigment for children's toys, painting tent poles and otherwise.

where it is sold for 12 to 15 rupees a maund (80 lbs.). It is also brought from the Nari Province of Northern Tibet to Bagashwar Bazaar near Almora.

Both sulphides, as met with in commerce, usually contain much arsenious oxide, and are more or less actively poisonous according to the quantity of arsenious oxide present, as the sulphide is insoluble in water and also HCl. In India the sulphides of arsenic are used for criminal purposes much less frequently than arsenious oxide.

of cases of arsenical poisoning brought to the notice of the Chemical Analyser to Government.¹

¹ See Appendix XIV.

Human poisoning by the sulphides.—None of the seventeen cases mentioned above were homicidal; nearly all appear to have been cases of suicide. Chevers,¹ however, gives details of two cases of attempted homicide by orpiment introduced into food, and Waddell² mentions three fatal cases of poisoning by orpiment, of which two were homicidal, as having been brought to his notice in Bengal in one year (1884). In Bombay a few cases of poisoning or attempted poisoning by the sulphides have occurred, of which some (see *Cases* below) were cases of homicide or attempted homicide; the poison, in a few cases realgar, in a few others orpiment, and in a few the mixed sulphides, having been given, or attempted to be given, in articles of food.

Cases—Cases of poisoning by the sulphides of arsenic (*Bo. Chem. Analyser's Repts.*).—(a) In Bombay several persons were poisoned, all of whom, however, recovered, by orpiment contained in food. The poison was introduced into the food in turmeric powder, which, on examination, was found to contain over 90 grains of orpiment per ounce.—(b) The wife of a man who was very ill with fever confessed to giving orpiment, apparently in some *congi* (rice starch). The husband died three days afterwards; traces of arsenic were found in his viscera. The *post mortem* appearances were much congestion, and inflammation in patches of the gastro-mucous membrane, small intestines also inflamed, and in parts in a state approaching mortification, liver and spleen enlarged, and signs of commencing inflammation of both lungs.—(c) In another case orpiment was found in some cooked rice. A man who had partaken of a

who died from arsenical poisoning, some sugar mixed with rat poison,

Abortifacient use.—Orpiment seems to be sometimes employed as an abortifacient, or ingredient of abortifacient preparations.

In one of the 17 cases above noted orpiment appears to have been taken with the object of procuring abortion. In several cases in Bombay,

¹ *Med. Jur.*, p. 123.

² *Beng. Chem. Ex. Rept*, 1884.

opment was found in packets discovered in the possession of persons charged with procuring abortion; and in one or two cases in powders stated to have been given with this object. In one of these last-mentioned cases, the poison was apparently present in the form of sulpho-arsenite of

drugs, a board used for mixing, and two stones used for grinding the drugs employed, were found to be stained with malgar and red lead.

Detection.—When pure, the sulphides are practically insoluble in water and hydrochloric acid. Heated *per se*, they yield a mixed sublimate of sulphuric and oxide. Their identification is best effected by the reduction process, converting the ring of metallic arsenic obtained into arsenious oxide, to which, after solution in boiling water, the liquid tests for arsenious oxide may be applied.

Arsenites of Copper.

Two of these are in common use as pigments, namely, *Schulz's green*, CuHAsO_3 (acid cuprio arsenite), and *Schumann-furth's or emerald green* (aceto-arsenite of copper), $3\text{CuAs}_2\text{O}_4 + \text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$. Both are known in India under the name '*Hirwa*.' Both, although insoluble in water, are readily dissolved by the acid fluids of the stomach, and when absorbed give rise to the usual symptoms of arsenical poisoning. They are seldom used in India either by homicides or suicides; occasionally accidental cases occur. In Bombay, two instances of alleged attempt at homicide by arsenite of copper (see *Cases*, p. 497) have occurred; and several cases of suicide by arsenite of copper have been reported in Bombay and Calcutta. Cases of poisoning by the arsenites of copper usually arise either from their being used in ignorance to colour confectionery or toys or from their accidental absorption into the system from other articles coloured by them.

A whole family were poisoned by *halwa* (a kind of sweet-meat) thus coloured in Bombay, and Taylor records a fatal case arising from eating blancmange, coloured with arsenite copper. Again, in several instances, arsenite of copper is used to colour small sugar-plums known as *til-gul*, which are sold at the *Maakar Sakrant* festival;¹ and Dr. W. Center states that the confectioners of Lahore use arsenite of copper to colour their wares.² Taylor mentions several instances of children being

¹ In January. In one instance the *til-gul*, from a vendor's stock, green, red, and yellow sugar-plums, was coloured respectively with aceto-arsenite of copper, mercuric sulphide, and chromate of lead.

² *Ind. Med. Gaz.*, 1874, p. 116.

poisoned by confectionery coloured with these compounds. Cases of the second class are often cases of chronic or slow poisoning, arising from inhalation of particles of the poison, detached from wall papers coloured with arsenical green. Chevers mentions one such case as having occurred in India, also another where the poisoning resulted from sleeping in a bedroom, the walls of which had been coloured with arsenite of copper, loosely put on with size.¹ Children again are sometimes poisoned by sucking green arsenical paint off toys (see *Case below*).

Suicidal poisoning by arsenite of copper.—A case of poisoning by Scheele's green was referred by the Coroner of Calcutta in May, 1910

Homicidal poisoning or attempted poisoning by the arsenites of copper (*Bo. Chem. Analyser's Rept*)—(a) A woman was found in the act of putting something into a pot of drinking-water standing in the house of a Bhora (trader). She was seized, and a packet found in her hand, in which was a quantity of aceto arsenite of copper. In the struggle the pot got broken, and the water spilt, but aceto arsenite of copper was found in some earth collected from the spot.—(b) A woman charged a man, described as her "kept husband," with an attempt to poison her,

symptoms of irritant poisoning, the result of sucking the paint off a toy parrot painted bright green with arsenite of copper.

evolved.

Other Poisonous Arsenical Compounds.

'Rough on Rats' has been used for suicide, see cases below.

of arsenious acid. The *post mortem* examination revealed the presence in the uterus of a four weeks' fetus.—L. A. Waddell, *Beng. Chem. Ex. Rept*, 1896

¹ *Med. Jur.*, p. 125.

Fly-powder.—This is a black powder, consisting of, or containing metallic arsenic, partly converted into arsenious oxide. 'Fly-papers' (*Arsenate*, see below) were used as a source of arsenic in the Maybrick case (p. 475).

Arseniuretted hydrogen.—This highly poisonous gas is evolved when hydrogen is set free from materials, or in liquids, containing arsenic (see *Marsh's Process*, p. 505). A few cases of poisoning by it, all accidental, have been reported. **Alkaline Arsenites.**—These are more soluble in water than arsenious oxide. Cases of poisoning have been recorded from Fowler's solution (Liquor Arsenicalis B.P. and L.P.), which is a weak solution of potassium arsenite, coloured with compound tincture of lavender, strength, L.P., four grains of arsenious oxide to the ounce,¹ or B.P. of 1835, 4.375 grains to the ounce, or 1 per cent. Cases (see p. 485) have also occurred from the use of arsenious oxide, mixed with potassium carbonate solution (potassium arsenite), as sheep wash; and Taylor mentions a case in which 340 school-children were poisoned by drinking tea made with water from a boiler into which mixed arsenite and arsenate of sodium had been put, in order to cleanse it from deposit. 'Weed-killer' (Arsenate of Sodium) has caused several deaths by using the empty casks for culinary purposes or water storage (*Lancet*, 1891, 900). **Alkaline arsenates.**—These rarely give rise to cases of poisoning. Taylor² refers to three accidental cases, and gives details of one attempt at homicide; in the latter, arsenate of potassium was given in wine. Paper soaked in solution of an alkaline arsenate mixed with sugar is used for poisoning flies, under the name of *Papir Mouré* or Fly paper. Arsenate of potassium is used for preserving skins, and has lately been imported into India for this purpose. Chevers³ mentions two cases (both in Panjab) of attempted cattle poisoning by pieces of grass moistened with solution of potassium arsenate. Arsenic in **dyeing materials.**—A large number of dyes, of various colours, are obtained from rosaniline, a red colouring matter prepared by the action of an oxidizing agent (usually arsenic acid) on aniline. Red aniline dyes have been found to contain arsenic

Cacodylates of Arsenic. These have lately been introduced as antisyphilitides under a variety of names, 'Atoxyl,' '666,' *Salvarsan*, etc. Many cases of poisoning by them are reported. Death from *Salvarsan* and allied preparations has frequently resulted from:—

¹ This was the strength of the preparation of the B.P. of 1867.

² *Poisons*, p. 251.

³ *Med. Jur.*, p. 133.

(1) Extensive sloughing when administered subcutaneously or intramuscularly.

(2) From pulmonary thrombus and embolism through faulty technique in injecting muddy solutions intravenously.

(3) From hyperpyrexia, vomiting and purging. In these cases the *post-mortem* signs are generally injection and ecchymosis of the mucosa of the stomach (probably due to the fact that much of the arsenic is excreted into the stomach), in injection and parenchymatous inflammation of the kidneys and in many cases sub-endocardial hæmorrhages.

(4) A hæmorrhagic encephalitis, coming on later with symptoms of paralysis and coma, characterized *post mortem* by dotted hæmorrhages in the brain and its membranes.

Double optic neuritis common in atoxyl poisoning is rare with Salvarsan.

The signs were identical in 19 horses dead through atoxyl intravenous injections for snrta which Professor Powell examined *post mortem*.

Liquid reactions of arsenic acid.—Arsenic acid differs from arsenious acid in giving (1) a red-brown precipitate with silver nitrate, and (2) in moderately strong solution, a precipitate with a mixture of ammonia, ammonium chloride, and magnesium sulphate solutions. An acidulated solution of arsenic acid is precipitated by sulphuretted hydrogen much more slowly than a similar solution of arsenious acid.

Detection of Arsenic in Viscera, etc.

Arsenic is not a cumulative poison in the usual sense, as though temporarily deposited in organs, after absorption it is rapidly eliminated by the urine and other secretions, hence the importance of preserving the urine for analysis. Sir T. Stephenson found it in the urine for four days after a poisonous dose (Taylor, II., 490).

the destruction of organic matters mixed with it. Hence to separate arsenic from organic matter, and bring it into a form in which it may be readily recognized, special processes are required. For the detection of arsenic in bones, see p. 506. Before describing these, certain points bearing on the inferences to be drawn from the analytical results must be considered.

1. Disappearance of arsenic from the body (a) after death.—Arsenic, like other inorganic poisons, cannot disappear

by putrefaction. Hence it may be detected in human remains after any period of interment. Its antiseptic power and the sparing solubility of its most commonly used compounds, tend specially to favour this. On the other hand, arsenic, being volatile at the temperature of combustion, may disappear when

cases complete disappearance from the contents of the stomach may take place very rapidly.

Taylor¹ mentions a case where this occurred within 24 hours; and I once met with a case in which arsenic could not be detected in the contents of the stomach of a woman who died from arsenical poisoning in six hours.² On the other hand, two cases are recorded, one of death in six, and the other of death in seven days, in both of which arsenic was found after death in the contents of the intestines.³ During life also, absorption of the poison takes place very rapidly. Taylor found it in comparatively large quantity in the liver in a case of death in three hours.⁴ Again, during life, absorbed arsenic tends to

On the whole, therefore, (1) Entire absence of arsenic from the body is quite consistent with the supposition of death (after some days) from arsenical poisoning; it, however, strongly indicates survival for some days; and (2) In case of a death from arsenical poisoning, absence of arsenic from the alimentary canal is a moderately strong indication that the individual lived some time after swallowing the poison, the indication being stronger if arsenic is found to be absent from the contents of the intestines, as well as from the contents of the stomach.

Cases.—Death from arsenical poisoning.—Complete elimination of arsenic from the body.—(a) (Taylor, *Poisons*, p. 335). A woman was

¹ *Poisons*, p. 335.

² *Bombay Chem. Analyser's Rept.*, 1879-80. The poison was given in food, arsenic was detected in the liver

³ Taylor *Poisons*, p. 336.

⁴ *Ibid.*, p. 334.

suffered during the whole time from purging and vomiting." Not a trace of the poison could be found in either the stomach or liver. Dr. Wellington Gray, who made the analysis, remarks in reference to this case "It is quite possible that arsenic may have existed in the more distant tissues of the body for the examination of which no opportunity was given." Arsenious oxide was detected in some bread, a portion of which had been eaten by the deceased.

Case—Detection in cremated remains.—Two persons suffered from choleraic symptoms, and one of them died and was cremated; but when the other one also died in a few days, suspicion was aroused. The viscera of the latter and all the suspected articles connected with the case

be dissipated by fire and lost beyond the possibility of detection in anything reduced to ashes, but the conditions under which cremation is usually carried out here evidently do not favour complete combustion, and sublimation of the volatilized arsenic on the cooler parts of the funeral pyre is liable to take place and its loss thus prevented. This is borne out by another such case which was examined during the year, in which arsenic was easily detected in ashes and charred bones, etc., sent from the cremation ground. The point is one which is worth noting by magisterial and police-officers who have to investigate cases of suspected poisoning, in which the corpse has been cremated.—*Mad. Chem. Ex. Rept.*, 1902.

Case—Detected in dead body after six months.—The Civil Surgeon of Jessore sent abdominal contents of a person who had died of a foul play in six months and absent history point. A chemical examination was found to contain arsenic.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1912.

2. Conversion in the body of arsenious oxide into yellow sulphide of arsenic.—It has already been pointed out that this may occur; the reverse change cannot, however, take place. The discovery, therefore, of arsenious oxide in the body shows that the poison administered contained arsenious oxide. On the other hand, the discovery of yellow sulphide of arsenic in the body does not prove that the poison was administered in the form of yellow sulphide.

3. Presence of arsenic in earth.—Arsenic is sometimes found in minute quantity in earth, but has hitherto only been found in earth in a form insoluble in water. It has been alleged, however, that arsenical earth may, under the action

of the air, yield a soluble arsenical compound. Further, it has been found that when arsenic in solution is introduced into the alimentary canal of a dead body, *post mortem* imbibition takes place, and arsenic passing through the walls of the alimentary canal becomes imbibed by tissues external to but in contact therewith.

In the case, therefore, of an exhumed body, in the viscera of which arsenic has been detected, it may be alleged that the arsenic found therein was derived from the surrounding earth. Either of two cases may arise. The parietes of the body may be found (1) intact, or (2) not intact, and the viscera more or less mixed with earth. In case (1) the discovery of any notable quantity of arsenic in the body completely negatives the theory of earth derivation. The presence of traces even can hardly be accounted for in this way. In case (2) the earth derivation theory is in the highest degree improbable if a notable quantity of soluble arsenic is detected. Whenever, however, case (2) arises, a portion of the surrounding earth should always be submitted to analysis, and even in case (1) it is advisable to preserve a portion of the surrounding earth, so that it may be examined for arsenic, should traces only thereof be found in the body. In India vomited matters are frequently found mixed with earth; here, again, it is important to ascertain whether or not arsenic present in such matters, is present in a form soluble in water. Should soluble arsenic be present, and especially if it be present in notable quantity, earth derivation is improbable.

theory of earth derivation.

4. The wrappings or envelopes employed to enclose suspected poison or poisoned food sometimes contain arsenic; for example, yellow packing waxed cloth occasionally contains traces of arsenic—and this possibility should be excluded by a 'control' test.

Quantity of arsenic found.—The quantity of arsenic found in the viscera of an individual may, to a certain extent, affect (a) the presumption as to suicide or homicide; or (b) the presumption as to the cause of death, as has already been considered. Bearing specially on the possibility of a minute quantity of arsenic being discovered in the viscera, in a case of death from causes other than arsenical poisoning, are the following points:—(1) the existence of the habit of arsenic eating and the frequent use by *hakims* of arsenic in the treatment of disease; (2) the possibility of earth derivation just

discussed, and (3) the fact that arsenic is *not* a natural constituent of the body, although the contrary was at one time asserted. It must not be lost sight of also that arsenic may be present in small quantity, as an impurity, in drugs administered for medicinal or other purposes and in reagents. Antimony and bismuth¹ compounds are liable to contain traces of arsenic; so also is sulphuric acid, and it has already been mentioned that realgar has been found in opium.

Processes for separating Arsenic from Organic Mixtures.

The principal processes employed for the separation of arsenic from organic mixtures are: (1) deposition as metallic arsenic or copper, or Reinsch's process; (2) separation as arseniuretted hydrogen, or Marsh's process; (3) separation by distillation as chloride of arsenic; and (4) separation by precipitation as sulphide of arsenic. Many of the reagents used in the above process, *eg* sulphuric acid, hydrochloric acid, metallic zinc and metallic copper, are specially liable to contain arsenic. All should, therefore, be ascertained to be arsenic-free before use. As regards metallic copper, however, see Reinsch's process.

Reinsch's process.—This consists in boiling the suspected liquid acidulated with about one-fourth of its volume of hydrochloric acid (or solid matters cut into small pieces and mixed with hydrochloric acid diluted with about two volumes of water), with a succession of pieces of clean, bright, metallic copper foil or gauze.

The strip of copper used in the test should first be cleaned in the following way. Prepare a mixture containing water 100, sulphuric acid 100, nitric acid 50, and hydrochloric acid 2 parts. A few drops of this acid mixture are allowed to fall on the strip of copper. The acid is immediately washed off in running water and the copper at once used for the test (Hankin). If arsenic is present, a steel-grey or black stain—an alloy of arsenic and copper—forms on the surface of the foil or gauze. The stained pieces of copper are

¹ Dr. Richardson, in the case of *R. v. Southurst*, stated that in the bismuth usually administered in medicine (sub-nitrate) he had found nearly half a grain of arsenic per ounce, and that in one case, where for dyspepsia five grains of bismuth had been given three times a day for six days, he had found about a fiftieth of a grain of arsenic in the patient's urine. Dr. Thudicum, at the same trial, stated that he had found both arsenic and antimony in sub-nitrate of bismuth, and also in grey powder.

then washed,¹ dried, and heated in a test-tube,² when the stain, if arsenical, disappears, and a sublimate of arsenious oxide is obtained, which, under the microscope, is found to consist of minute crystals of the characteristic appearance before noted. Unless such crystals are obtained, the presence of arsenic has not been demonstrated, because the staining of the copper may be due to (1) the action of organic matter only, or the formation of sulphide of copper, or (2) the deposition on the copper of metals other than arsenic, *e.g.* mercury, antimony, silver, bismuth, etc. Under the circumstances of the process, however, of the metals other than arsenic which deposit on copper, two only yield sublimate, *viz.* mercury, which yields a sublimate of minute globules of metallic mercury, and antimony, which yields a non-crystalline sublimate. Reiusch's process is the most generally applicable of all. It cannot, however, be used in cases where the liquid contains matters which dissolve the copper, *e.g.* nitrates, chlorates, or ferric chloride. It is only also in such cases that the presence of arsenic in metallic copper can lead to error.³ Hence, if the copper dissolves, or the deposit forms only very slowly thereon, one of the other processes should be resorted to.

When carrying out Reiusch's test on vomit mixed with ashes, the addition of a further quantity of acid may be required, as part of the acid will have been neutralized by the alkali of the ashes. Occasionally in cases in which vomit has been mixed with earth, it will be found that the strip of copper during the boiling shows signs of corrosion and may ultimately dissolve. This effect is probably due to the presence of nitrates. Should this occur a fresh sample of the earth-vomit mixture should be placed in a basin with dilute hydrochloric acid and raised to the boiling point. Some powdered ferrous sulphide is then added. After boiling for a short time the mixture is allowed to cool and kept till the next day. It is then boiled for some time (to drive off H_2S) and the strip of copper is added. The arsenic if present will then be found to be deposited in the normal way (Hankin).

³ an arsenical deposit formed on the copper cannot be due to the presence of arsenic in the copper employed.

A Windsor's clip is very useful in carrying out the Reinsch test. This consists of a glass rod of which the end has, while heated, been twice bent round parallel to itself. The rod thus prepared is used as a clip to hold the piece of copper (Hankin).

Marsh's process.—This consists in introducing a liquid suspected to contain arsenic, into a vessel from which hydrogen gas is being evolved. If arsenic be present, the nascent hydrogen attacks it, forming arseniuretted hydrogen. The arsenical nature of the gas evolved may be proved: (1) By passing it through a narrow hard glass tube, heated to redness for a portion of its length, when a deposit of metallic arsenic forms in the cool part of the tube beyond the heated portion. (2) By igniting the gas, and holding a piece of cold white porcelain in the flame, when a deposit of metallic arsenic forms thereon (see Fig. 30). (3) By passing the gas through solution of silver nitrate, when a black deposit of metallic silver is thrown down, and the arsenic is converted into arsenic acid, which remains in solution. The arsenical nature of these products of the process is proved as follows:—(1) The portion of the narrow tube containing the deposit or ring of metallic arsenic is heated in a wide tube, like the metallic ring in the reduction process (see p. 493). It volatilizes readily, yielding a similar crystalline sublimate. (2) The spots on porcelain, where thin, are seen to be hair-brown in colour, and (a) are soluble in chloride of lime solution, (b) are insoluble in stannous chloride solution, and (c) dissolved in aqua regia, the solution when evaporated to dryness, yielding a residuo of arsenic acid, which gives a brick-red precipitate with silver nitrate solution. (3) The silver nitrate solution is treated with excess of hydrochloric acid, filtered, and the filtrate evaporated to dryness, silver nitrate solution added to the residue gives a brick-red precipitate. The apparatus used may be an ordinary gas-bottle, such as is employed for preparing hydrogen gas, fitted with a tube filled with fused calcium chloride (for the purposes of drying the gas evolved), to which is attached a long narrow hard glass tube, ending either in a jet or a downward bend. The materials used may be zinc and dilute sulphuric acid, or zinc and hydrochloric acid. A quantity of hydrogen gas must be allowed to escape before heat is applied to the narrow tube

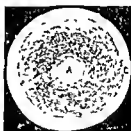


FIG. 30—Deposit in Marsh's Test.

A.—Metallic Arsenic. B.—Mixed Metallic Arsenic and Arsenious Oxide (anhydride). C.—Arsenious Oxide (anhydride).

(avoidance of explosion). Before the suspected liquid is introduced, the narrow tube must be heated to redness for about fifteen minutes. If no deposit forms, the materials are arsenic-free. In this way the purity of the hydrochloric acid used in Reinsch's and other processes may be ascertained. Bloxam's modification of Marsh's process consists in evolving the hydrogen gas required by electrolytic decomposition of water acidulated with sulphuric acid. In this way the use of zinc (which frequently contains arsenic) is avoided. In another modification, Fleitmann's, applicable to arsenic but not to antimony, the hydrogen is evolved by heating zinc with potassic hydrate solution. Marsh's process is not applicable to the sulphides of arsenic, or to solutions containing arsenic as arsenic acid, or as an arsenate (see, however, below).

this might lead to a dangerous accident if the flask were to crack. And heating, the flask is set aside till the next day. Crystals of ferrous ch
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A flask while the distillation is going on. The arsenic passes into the distillate, and should be collected in a receiver cooled with ice. Its amount may be estimated by means of Marsh's test (see Collins, the Analyst, vol. XXVII., p. 229, June, 1912).

Precipitation as sulphide of arsenic.—Mixtures containing little organic matter may be boiled with dilute hydrochloric acid, filtered, and the filtrate precipitated by washed sulphuretted hydrogen. If much organic matter be present, this must be first destroyed by boiling the substance under examination (cut into small pieces if a solid) with dilute hydro-

¹ To reduce the arsenic acid, Marsh's process may be applied to the detection of arsenic acid and the arsenates, if these be first treated with sulphurous acid.

sulphide of arsenic may then be subjected at once to the reduction process, or (for quantitative determination of the arsenic present) treated as follows.—Boil with strong nitric acid, evaporate to dryness, dissolve in a little water, filter, and add to the filtrate a mixture of solutions of magnesium sulphate, ammonium chloride, and ammonia. After twenty-four hours filter, wash the precipitate with ammonia-water, dry and weigh. It consists of ammonium magnesium arsenate, and contains 39.47 per cent. of metallic arsenic.

Antimony.

Antimonial poisoning is extremely rare in India. It usually arises from the potassio-tartrate or tartar emetic. A few cases also are recorded of poisoning by the chloride (butter of antimony)

• **Tartar emetic.**—This, also called potassio-tartrate of antimony and tartarized antimony, produces effects on the system very similar to those produced by arsenious oxide. Unlike the latter, however, it has a strong metallic taste. Tartar emetic has a very marked depressant action on the heart, and on the nervous system generally. Hence, in poisoning by it prominent symptoms are extreme faintness, collapse, and muscular weakness. Loss of voice has been noticed, and choleraic symptoms,¹ and convulsions often precede death. In exceptional cases (as in arsenical poisoning), vomiting is slight or absent, necessitating the administration of emetics. Tartar emetic applied to the skin produces a pustular eruption thereon, and may become absorbed, giving rise to constitutional symptoms. A pustular eruption on the skin has also been noticed in cases of poisoning by internal administration of the drug.

Acute poisoning by tartar emetic is seldom homicidal, it is frequently accidental from the poison being mistaken for some harmless powder, e.g. Epsom salts, or carbonate of soda. It may also be remarked that, although tartar emetic is popularly well known to be a powerful emetic, it is not equally well known to be a powerful poison. It is possible that this may explain the mysterious Bravo case (see below)

Cases.—Antimonial poisoning—(a) **The Bravo case** (July, 1876). In this case Mr. Bravo, a young married man of good position, died undoubtedly from poisoning by tartar emetic. Deceased, on the evening he was attacked with symptoms of poisoning, stated—so one of the witnesses at the inquest deposed that, owing to jealousy of his wife, he had taken poison. Shortly after this he became very ill, and medical assistance was sent for. Sir W. Gull, one of the physicians called in, stated that he told the patient that the symptoms were due to poisoning, and asked him how he came by it. He answered 'I took it myself.'

¹ Christison *Poisons* p. 452 (2nd Ed.)

Asked what he had taken, he replied, "Laudanum." Told that he must have taken more than laudanum, he said, "Before God, I only took laudanum." There was no evidence to show how deceased came by the tartar emetic, from the effects of which he died, and the coroner's jury returned a verdict of wilful murder against some person or persons unknown—(b) *Reg. v. Smethurst* (Browne and Stewart's *Trials*, p. 448).

urged that several of the symptoms of slow poisoning by arsenic or antimony were absent, e.g. there was no conjunctivitis, no skin disease, and no excoriations at the orifices. That the symptoms, etc., might have been due to acute dysentery. That the vomiting and diarrhoea from which deceased suffered might have resulted from her being in an early state of pregnancy. That the traces of antimony found in the viscera (and a minute quantity of arsenic found in an evacuation passed by deceased) might have been due to the presence of arsenic in the bismuth, and of antimony in the prisoner was convicted.

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confessed his guilt.—(d) *R. v. Klosowski, C.*, in *Times*, March 20, 1900, was an important case.

Chronic poisoning.—Some remarkable trials for murder, by the administration of repeated small doses of tartar emetic, have taken place in England (see *Reg. v. Smethurst*, and Dr. Pritchard's trial, *Cases* (b) and (c), *supra*). In some cases of chronic antimonial poisoning, the failure of ordinary medical treatment to control the prominent symptoms, viz. nausea, vomiting, and diarrhoea, with great depression and muscular weakness, has been the first thing to excite suspicion as to the true nature of the case.

Preparations containing tartar emetic.—*Vinum antimoniale* B.P. and I.P. contains 2 grains of tartar emetic per ounce. Tartar emetic is also contained in small quantity in several quack pills, e.g. Dr. Johnson's, Mitchell's, and Dixon's pills,¹ and forms one-fifth by weight of the *Unguentum antimonii tartarati* B.P. and I.P. Fatal period.—Shortest recorded, seven hours (in a female, *æt.* 21).² Longest, one year.³ Usual,

¹ About one-sixteenth to one-twenty-fifth of a grain in each pill (*Bl.* *Poisons*, p. 547).

² Wormley, *Poisons*, p. 218

³ Guy's *For. Med.*, p. 426.

ten hours to four days. Fatal dose—Smallest (in a child), three-quarters of a grain. Largest non-fatal, half an ounce. Taylor considers that, under circumstances favourable to the action of the poison, ten to twenty grains taken at once, might prove fatal to an adult; but that, if taken in divided doses, a smaller quantity might suffice.¹ *Post mortem* signs.—Similar generally to those of arsenical poisoning. Aphthous inflammation of the mouth, throat, and gullet, and aphthous ulceration of the small intestines, have been observed. Treatment.—The usual treatment for irritant-poisoning, with the administration as an *antidote* of an infusion containing tannin, *e.g.* solution of tannic acid, decoction of oak-bark, or of cinchona bark, or strong tea. Stimulants may be required to counteract depression.

Other Antimonial Compounds.

Trichloride, or butter of antimony, SbCl_3 .—A strong solution of this is used for browning gun barrels, also sometimes in surgery as a caustic, and in pharmacy as a source of oxide of antimony. It is highly corrosive, giving rise, when swallowed, to symptoms of corrosive poisoning, plus constitutional effects similar to those caused by tartar emetic. A few fatal cases of poisoning by the chloride of antimony are recorded. In one of these narcotism succeeded the usual irritant symptoms. The *post mortem* appearances are those of corrosive poisoning. Antimony, trioxide, Sb_2O_3 , although insoluble in water, is soluble in the fluids of the stomach. It is used in medicine in the form of *Pulvis antimonialis*—an imitation of the old James's powder—a mixture of one part of oxide of antimony to two of phosphate of lime. Its action on the system is similar to that of tartar emetic, but milder in degree. Over doses of it have given rise to dangerous symptoms. Antimony trisulphide, Sb_2S_3 .—This is met with in two forms (1) as a black crystalline mass or powder—native sulphide of antimony, black antimony, or 'surma',² and (2) as an orange coloured powder—precipitated sulphide of antimony. Although pure sulphide of

monium sulphuratum of the B.P. and I.P., and this forms about one fifth by weight of Plummer's pills (*Pilula hydrargyri sub-chloridi, composita*, B.P. and I.P.).³

Detection of antimony.—Antimony after absorption is eliminated mainly by the urine, and may be detected during life in this fluid. It is probably eliminated from the body at least as rapidly as arsenic. Like arsenic also, antimony does not disappear by decomposition, and has been detected in the body after long periods of interment.

Detection of antimony in organic mixtures.—To Reinsch's process (see p. 503) antimony, like arsenic, yields a deposit on copper, which,

Mercury.

One of the most poisonous salts of mercury—the perchloride—is sold in every bazaar and is kept in the shops alongside spices, so that accidental poisoning is not uncommon in India.

Mercurial poisoning may be acute or chronic.—If acute, the symptoms may be either those of corrosive or those of non-corrosive irritant poisoning. If chronic, either salivation or mercurial tremors, or both, may be present; and in two cases of chronic poisoning by an organic mercurial compound (mercuric methide) the brain was specially affected.

Acute mercurial poisoning.—Accidental cases are, however, homicidal cases,² commonly arises from case, and also when the pills are swallowed, the symptoms present are those of corrosive poisoning.

In acute cases other than these, the symptoms are those of non-corrosive irritant poisoning, and vary in severity according to the activity of the compound swallowed. Mercuric compounds are more active than mercurous compounds. Soluble mercurial salts have a strong metallic taste. In corrosive cases (1) intense burning pain in the mouth and throat comes on immediately, and (2) the lining membrane of the mouth and throat becomes white and shrivelled. These characters are absent in non-corrosive cases. In both corrosive and non-corrosive cases the usual symptoms of irritant poisoning are present, and more or less complete suppression of urine is a common symptom. In some cases coma has been observed. If the case is prolonged, salivation, as in chronic poisoning, may appear; but this is not a common symptom in acute cases.

Case—Acute mercurial poisoning.—A convict, in Port Blair, was

him. He swallowed the draught and immediately he felt a burning in his mouth and gullet. Directly afterwards the whole throat became painful, and he could hardly swallow, and he became restless. Soon he began to vomit food mixed with blood and passed bloody stools with great pain. He was in this condition when brought into the hospital. In the hospital he had all the symptoms of irritant poisoning. Besides bloody

nation. *Traces of mercury only were detected in the portions of viscera sent for analysis. But both mercury and arsenic were detected in his vomit and stools. It appears from this case that mercury is not so easily eliminated from the system as arsenic. For although the man was in the hospital for nearly a month and a half, traces of mercury were still detected in his viscera, but no arsenic could be found in them. In this case, as the symptoms of mercurial poisoning were so marked, and as the quantity of arsenic found in the stools and vomit was so very small, it may be presumed that arsenic was present in only small quantity as an impurity in the mercurial preparation which had been administered to the deceased.—L. A. Waddell *Benj Chem Ex Rev*, 1897

Post mortem signs.—These according to the case, may be those of corrosive, or those of non-corrosive irritant poisoning. Perforation of the stomach is rare. The gastric mucous membrane may be found covered with a greyish deposit of metallic

mercury, or there may be a black deposit of the sulphide. The intestines and urinary organs are generally much congested. In acute poisoning from external application of mercurial compounds, *post mortem* appearances of irritation of the alimentary canal are present.

Treatment.—The usual treatment for corrosive or irritant poisoning, with the administration as an antidote of albumen (*c.g.* white of egg) or other albuminous fluids.

Chronic mercurial poisoning is liable to arise in persons whose occupation exposes them habitually to the vapours of metallic mercury or its compounds, or to constant contact with mercurial compounds. It may also arise from often repeated small doses of any mercurial preparation, and hence may result from the abuse of such preparations in the treatment of disease. Cases of this last description used formerly to be of frequent occurrence in India. **Symptoms.**—These may be debility, nausea, and vomiting, accompanied by colicky pains, and followed by salivation. In other cases, mercurial tremors are the first symptoms to appear.

Salivation.—This commences with a coppery taste in the mouth. The gums swell and become tender and spongy. There is profuse ptyalism, fetor of the breath, and febrile disturbance. A blue line may be present on the gums. In extreme cases, the tongue and cheeks swell, ulceration appears in the mouth, the jaws become necrosed, and the teeth drop out. Mercury is present in the saliva. Salivation may (1) last for almost any period: in one exceptional case it is said to have lasted six years. (2) Intermit, and recur after an interval of three months or more. In exceptional cases also, an interval of three months or more has been observed between the discontinuance of mercurial treatment and the first appearance of salivation. (3) Appear in acute cases, but rarely appears in these under twenty-four hours, although one case is reported where it appeared in three hours. (4) Arise from very small doses.—Idiosyncrasy in some cases renders an individual specially amenable to the effect of calomel.

Children, it may be noted, bear mercury better than adults. (5) Arise from causes other than administration of mercury.—Thus it has resulted from the administration of compounds of arsenic, antimony, copper, lead, bismuth, and gold; also from administration of iodine, sulphuric acid, hydrocyanic acid, digitalis, cantharides; colchicum, croton oil, opium, carbolic acid,

and nitro-benzene, and may occur idiopathically. In non-mercurial salivation, mercury is, of course, absent from the saliva. *Cancerum oris*, a disease liable to affect children, especially those that are cachectic or badly fed, has been mistaken for mercurial salivation. Taylor¹ mentions a case in which a child, having died from *cancerum oris*, a charge of malpraxis was brought against the medical attendant. It was, however, proved that no mercury had been administered. Mercurial tremors, or shaking palsy.—This as a rule comes on gradually, affecting first the muscles of the arms, and subsequently those of other parts of the body. The affection begins with unsteadiness and quivering, increasing to tremors, which ultimately become so violent as to resemble convulsions. All voluntary movements requiring the aid of the affected muscles can only be performed by violent starts. In advanced cases, walking, articulation, and mastication all become affected. Finally there is loss of memory, sleeplessness, delirium, and death. The skin is dry, and has a brown tint. Salivation may or may not be present.

Mercurial Preparations and Compounds.

(a) **Corrosive sublimate**, Mercuric chloride, HgCl_2 —*Talachikna sumbul Darchikna* (Hind.). This occurs in heavy crystalline masses, or as white crystalline powder. In the crude form, as obtained in the bazaars, it is an impure mixture with subchloride.

Heated, it is
soluble in alcohol
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than in pure water

The ordinary medical dose is one-sixteenth to one-eighth of a grain, and three to five grains may be regarded as a minimum fatal dose. A case of recovery after swallowing an ounce is on record. The usual fatal period is one to five days, but in one case death occurred in half an hour. Corrosive sublimate is readily absorbed through the unbroken skin, and acute poisoning, non-corrosive in character, may arise from its absorption. It is contained, to the extent of half a grain per ounce, in the *Liquor hydragryi perchloridi* B.P. and I.P.

Case—**Corrosive sublimate**.—Suicide.—In a case of suicide by mercurial poisoning, nearly eight grains of corrosive sublimate were found in the visceral and vomited matters. The unfortunate individual suffered such intolerable agonies from the poison that he rushed into the bath

¹ *Praxis*, p. 370

yard and jumped into a well, from which he was rescued and taken to hospital
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 1898.

Case — Corrosive sublimate in pudenda — Homicide — Death.—In 1898, in Madras, a man surreptitiously thrust a piece of corrosive sublimate into the pudenda of his wife to punish her. Intense local inflammation resulted, followed by ulceration and constitutional symptoms, from which the woman died 12 days after. Accused got 10 years' rigorous imprisonment — *Mad. Chem. Ex. Rept.*, 1898.

(b) **Nitrates of mercury**, viz. normal mercurous Hg_2NO_3 and normal mercuric Hg_2NO_3 . These salts are freely soluble in water containing nitric acid, but pure water is liable to decompose them, with formation of sparingly soluble basic nitrates. Heated, they decompose, giving off red fumes of nitric oxide, and leave a residue of mercuric oxide. Swallowed, they produce symptoms similar to those caused by swallowing corrosive sublimate. A fatal case from external application of nitrate of mercury in a liniment is recorded; also a case of chronic poisoning from its use as a local application to the neck of the uterus, and another case where a workman whose occupation for four years had been packing skins brushed over with solution of nitrate of mercury, died of chronic mercurial poisoning; others, however, similarly employed in the same factory were unaffected.

(c) **Other compounds**—(1) **Mercuric cyanide** $\text{Hg}(\text{CN})_2$.—This is a white soluble salt which, when heated, gives off an inflammable gas (cyanogen), and yields a sublimate of metallic mercury. Although non-corrosive, it is little less active than corrosive sublimate; ten grains has caused death. A case of acute poisoning (non-fatal) from swallowing the sulpho-cyanide $\text{Hg}(\text{SCN})_2$ is recorded. This, more correctly mercuric thiocyanate, is sold in little cones as a toy under the name of *Pharaoh's serpent*, so called from the serpentine form of the copious ash yielded by them when burned. Each cone weighs about 3 or 4 grains. (2) **Subsulphate**, Turpeth mineral, $\text{HgSO}_4(\text{HgO})_2$.—This is a yellow powder which, although sparingly soluble in water (1 in 2000 in cold, and 1 in 600 of boiling), has a strong metallic taste. Taylor mentions two fatal cases, in which the quantities swallowed were respectively forty and sixty grains. (3) **White precipitate**—Ammoniated mercury—Mercurammonium chloride, NH_2HgCl .—This is prepared by adding solution of ammonia to solution of corrosive sublimate. It is a white powder which

when boiled with water becomes yellow. It is soluble in nitric acid, but insoluble in water, alcohol and ether. According to Taylor, it frequently contains mercuric chloride as an impurity. It is only used medicinally as an external application for the cure of parasitic affections. Swallowed, it has caused severe symptoms in several cases, and at least one death. Chronic poisoning has arisen from its external application. Cases of recovery after swallowing thirty, forty, and one hundred grains, are recorded. (4) **Oxide—Red precipitate.**—This in its usual form is a red powder, slightly soluble in water. Heated strongly, it decomposes, with evolution of oxygen. When prepared by precipitation it is yellow in colour, and in this form is contained in the *Lotio hydrargyri flava* B.P. Cases of poisoning by it are rare. A fatal case from swallowing an ounce, and a case of recovery after swallowing half an ounce, have been reported. (5) **Sulphide Cinnabar** or '*Chinese Sindur*,'¹ *Vermilion*, *Hingula* (*Mar.*) *Hingul*, *Rasa sindura* or *Shingarf*.—This is met with either as a dark red crystalline mass, or as a bright red powder. It is only soluble in nitro-muriatic acid, and is entirely volatilized by heat. No acute case of poisoning by it in man has been met with, but cases of chronic poisoning have occurred from its use as a colouring matter for vulcanite plates supporting artificial teeth. A case of chronic poisoning from its over-use as a fumigant is referred to by Taylor. (6) **Methide.**—In two cases of slow poisoning by inhalation of mercuric methide vapour, in addition to salivation, there was impairment of the special senses, of motor power, and of the cerebral functions generally. In one of the two death took place by coma. In the other the patient became idiotic, and after remaining in this

which attracted the attention of the attendant, who put his finger into her mouth and brought out a small quantity of a yellow sulphur-like stuff, which was at once recognized to be a portion of the toy. Shortly after, she began to vomit, attended with severe retching. The matter first brought up consisted of frothy mucus mixed with the pale-yellow substance she had taken. She vomited several times within half an hour; she was then removed to a neighbouring dispensary, where she was given two doses of sulphate of zinc (15 grains each) followed by warm water drink. This brought on copious vomiting. The vomited matter was of a yellowish color, and the child was in a state of great exhaustion. A mixture of 15 drops of mixture, but

sleepy and prostrated for about three hours, and then began gradually to recover. The bowels were not moved, and she made water for the first time at 3 P.M., after the ingestion of the poison, and then freely again at about 5.30 P.M. She had fever in the evening (temperature 101° F.), which kept on during the night. There was no more vomiting and no purging. She slept well during the night and was found all right next morning. As in the case of poisoning by other salts of mercury, the symptoms were of an irritant nature.

On chemical analysis of the substance, mercury and sulpho cyanic acid were detected, and when burnt, it kindled and swelled into a bulky snake-like mass.

Mercurous compounds.—Insoluble or sparingly soluble mercurous compounds are much less actively irritant than similar mercuric compounds. Mercurous compounds are, however, prone to become converted into mercuric compounds. Some mercurous compounds, e.g. the oxide and iodide, undergo

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mercuric chloride. Of the sparingly soluble or insoluble mercurous compounds, the only one of medico-legal interest is: **Mercurous chloride, Calomel**—‘*Ras-kafur*,’ ‘mercurial camphor,’ on account of the vitreous camphor-like appearances of the masses of crude calomel, which is in India largely mixed with perchloride. Calomel occurs as a heavy, white, crystalline mass or amorphous powder, almost tasteless, and insoluble in water, alcohol and ether. It is entirely volatilized by heat and is blackened by solution of ammonia. The *ras-kafur* of the Indian bazaars contains a considerable but varying quantity of corrosive sublimate. An ordinary medicinal dose of calomel is two to five grains. In large doses it acts as an irritant poison, and in exceptional cases fatal salivation has been caused by ordinary medicinal doses. At the temperature of the body calomel is liable to be converted into corrosive sublimate by solutions of sodium or potassium chloride, and specially by

solutions of ammonium salts. In at least the following two cases death appears to have resulted from this transformation.

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corrosive sublimate for calomel.” This led to experiments being instituted,

the following case was referred to Dr Haines, then Chemical Analyst, Bombay, for opinion. A soldier in hospital at Canton, suffering from fever, was ordered pills, each containing three grains of calomel, two to

and ulceration were found in the stomach and pharynx. Experiments made by Dr Haines with reference to this case showed that, at the temperature of the body, solution of acetate of ammonia decomposes calomel, with formation of mercuric chloride and metallic mercury, the action being more rapid if excess of carbonate of ammonia is also present.

Metallic mercury.—*Rasa Para*, or liquid metallic mercury, when swallowed even in large quantity (one to two pounds), seldom produces any ill effect. In exceptional cases, however (*Cases* below), symptoms of chronic mercurial poisoning have been produced. A popular belief appears to exist in some parts of India to the effect that liquid mercury, when swallowed, causes injury to health. It was administered with this object in *Cases* (b) (c) and (d). Metallic mercury in vapour, or in fine division, readily acts on the system, hence workmen in mercury mines, barometer makers, mercurial gilders and platers, and others who are constantly exposed to mercury vapour, are liable to suffer from chronic mercurial poisoning, especially from mercurial tremors. The action of mercury in fine division is very similar to that of an insoluble mercurous salt, and in fine division it may be absorbed through the unbroken skin, and cause chronic poisoning. Mercury in fine division forms one third by weight of *Pilula hydrargyri B.P.* and *I.P.* (blue pill) and *Hydrargyrum cum creta B.P.* and *I.P.* The finely divided mercury contained in the latter preparation, in hot climates, liable to undergo conversion into mercuric oxide, the conversion being accelerated by exposure to light.

An individual was charged with attempting to poison a woman by administering to her liquid mercury in food. The woman is said to have vomited twice after taking the mercurialized food, and to have had "a red swelling of the gums, with bleeding on pressure of the finger,"

were extracted from a small quantity of sweetmeat, and in another three

pounds in the body." Cases (a) and (b), however, show that aqueous mercury sometimes acts as a poison

Detection of Mercury.

Elimination of absorbed mercury takes place mainly by the urine and saliva, and may be rapid or slow. The first is most likely to occur in cases of acute poisoning by a soluble mercurial salt, such as corrosive sublimate. Mercury was found to be completely absent from the viscera in a fatal case of poisoning by corrosive sublimate lasting only four days; and 7 days,

Hence death may occur from mercurial poisoning, and analysis fail to detect the presence of mercury. On the other hand, elimination of mercury occurs in some cases very slowly, and mercurial preparations are often used in the treatment of disease. Hence the discovery of mercury in small quantity in the viscera of a deceased individual, is quite consistent with the supposition of death from causes other than mercurial poisoning.

Solid compounds are most readily identified by reduction. The compound is mixed with powdered sodic carbonate, or powdered sodic carbonate and powdered charcoal, introduced into a test-tube and heated, when globules of metallic mercury sublime. In solution—

Mercuric salts² give (1) a yellow precipitate with potassic

¹ *Poisons*, p. 360.

² If the salt under examination is mercuric cyanide, it should be decomposed by HCl before other reagents are added.

hydrate; (2) a white precipitate with solution of ammonia, (3) a scarlet precipitate with potassium iodide soluble in excess, (4) no precipitate with hydrochloric acid; (5) a white precipitate, subsequently becoming grey or black, with stannous chloride, and (6) with sulphuretted hydrogen a precipitate at first white, subsequently orange, and lastly black. Mercurous salts give (1) a black precipitate with potassic hydrate, or solution of ammonia; (2) a white precipitate with hydrochloric acid or chlorides, blackened by ammonia; (3) a black precipitate with sulphuretted hydrogen; (4) with potassium iodide solution, a green precipitate, soon changing to grey if excess be added.

In organic mixtures mercury may be detected by Reinsch's process—On heating the coated copper, a sublimate of globules of metallic mercury is obtained. Or the matters having been boiled with dilute hydrochloric acid (1 to 4), the solution may be treated by the galvanic deposition process, as for antimony, using gold foil in place of platinum foil. The coated foil is then heated in a tube as in Reinsch's process (p 503). Quantitative estimation of mercury may be effected by precipitating it as sulphide. Corrosive sublimate present in sufficient quantity in organic mixtures may be separated therefrom by exhaustion with ether.

Zinc.

Poisoning by this metal is rare in India, and usually accidental, from swallowing either the sulphate or the chloride. Of these the first is a non-corrosive, and the second a corrosive irritant. Besides their local action, zinc compounds, when absorbed, exert a remote specific action on the nervous system, causing great prostration of strength, collapse, convulsions, and, in some cases, impairment of special sensation, e.g. of smell, sight and taste.

Zinc sulphate, white vitriol, ZnSO_4 —*Safed tutiya*.¹—This is a white crystalline, freely soluble salt, the crystals of which closely resemble in appearance those of magnesium sulphate.² In a few instances zinc sulphate has been used criminally, but, as a rule, cases of poisoning by it are accidental, and arise from its being mistaken for magnesium sulphate. When swallowed, it rapidly causes free vomiting, leading to complete, or almost complete, ejection of the poison, hence fatal cases are rare. Symptoms—The usual symptoms of non-corrosive irritant

¹ i.e. White crystalline salt.

² And also those of strontic acid.

poisoning. at prostration of strength. irritant poisoning. Dose. fatal cannot be stated with certainty. Half an ounce has caused death, but a dose of two ounces has been recovered from. As an emetic, zinc sulphate is given, in doses of ten to thirty grains, but it should be borne in mind that zinc sulphate is a poison. Hence if, as is sometimes the case in narcotic poisoning, vomiting is not produced, repeated doses are to be avoided. Acetate of zinc appears to act similarly to the sulphate, and may be used instead of it as an emetic.

Zinc chloride, $ZnCl_2$.—This is a white, very soluble, and very deliquescent salt, easily fusible, and in the solid condition often met with in cylindrical sticks. A strong solution of it—over 200 grains per ounce—is sold as a disinfectant, under the name of Sir William Burnett's disinfecting fluid. Cases of poisoning by zinc chloride are usually accidental, and most commonly arise from swallowing Burnett's fluid. A case, however, is recorded where death resulted from the application, by a quack, of zinc chloride as a caustic to a cancerous breast. Symptoms.—When swallowed in concentrated solution, as is usually the case, the symptoms are those of corrosive poisoning, followed, unless death occurs rapidly, by nervous symptoms, *e.g.* muscular weakness, tetanic convulsions, impairment of sight, etc. *Post mortem* appearances.—The lining membrane of the mouth and throat may be found bleached and white, or abraded and inflamed. The gastric mucous membrane has been found grey and corrugated, or inflamed, and in places destroyed; in one case the stomach was found perforated in two places. Where life has been prolonged, contractions of the gullet and stomach have been found. Dose.—Severe symptoms have been produced by twelve grains of the chloride. Half an ounce of Burnett's fluid has caused death, but recovery has taken place from doses of one to one and a half ounces.

Treatment of zinc poisoning.—The usual treatment for corrosive or non-corrosive irritant poisoning, according to the case. Carbonate of soda should be given as an antidote. Albuminous fluids may also be administered.

Detection.—Solutions of zinc salts (1) acidulated with HCl, give no precipitate with sulphuretted hydrogen; (2) give a white precipitate with ammonium sulphide; (3) give a white precipitate with ammonia solution, soluble in excess; (4) give a white precipitate with potassic hydrate solution, soluble in excess, and forming a solution from which sulphuretted hydrogen

throws down a white precipitate; (5) if a solution of a zinc salt be precipitated with sodic carbonate, the solution boiled, and the precipitate collected and ignited with a little cobalt nitrate solution in a platinum dish, the residue in the dish becomes bright green. From organic mixture, zinc may be separated by burning away the organic matter. The ash may be dissolved in dilute acid, zinc obtained from the solution as sulphide, the sulphide dissolved in a little nitric acid, and the solution treated as in (5) above.

Copper.

In India attempts at homicide, by the administration of the sulphate of copper in food or sweetmeat, are not uncommon, but the strong disagreeable metallic taste of this and other soluble copper salts, prevents their being used homicidally to any great extent.

Acute copper poisoning.—The accidental cases of poisoning by food cooked in copper vessels, tolerably frequent in India, are probably ptomaine or bacillary infection. Suicidal cases (see *Case* below) and cases where the poison has been taken with intent to cause abortion, and homicidal cases (see below) are occasionally met with and a fatal accidental case in a child, from sucking pieces of the sulphate has been reported.

Case.—Sulphate of copper poisoning—Suicide.—A Eurasian lady in Calcutta, in 1897, took a large quantity of sulphate of copper, and died from the effects thereof. The mucous membrane of the stomach and

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Ex. Rept., 1879

Symptoms.—A strong metallic taste in the mouth, followed by violent vomiting, and the usual symptoms of non-corrosive irritant poisoning. The vomited matters are usually bluish or greenish, becoming deep blue on addition of ammonia (coloration due to bile is unaffected by ammonia). In severe cases these irritant symptoms may be followed by convulsions, paralysis, and insensibility. In severe cases, also, suppression of urine is common, and jaundice, not present in arsenical or mercurial

poisoning, is a tolerably constant symptom. Fatal cases are rare. One ounce of the sulphate has caused, and probably less might cause, death, but doses of more than an ounce have been recovered from. Death has occurred (in the case of the child mentioned above) in four hours. In adult cases the fatal period is usually about three days. *Post mortem* signs.—Those usual in non-corrosive irritant poisoning, plus a yellow tinge of the body, and a blue or green colour, deepened by ammonia, of the contents of the stomach and intestines. Perforation of the intestines has been observed.

Treatment.—The usual treatment for non-corrosive irritant poisoning, with the administration, as an antidote, of albumen or albuminous fluids.

Chronic copper poisoning.—This has been met with, but is not common, among workers in metallic copper and its salts. It is also reported to have arisen from the use of plates as supports for artificial teeth, made of gold largely alloyed with copper. More frequently chronic copper poisoning has been traced or attributed to the contamination of articles of food with copper. The presence of copper, however, in articles of food habitually consumed, provided the quantity present be minute only, does not seem to give rise commonly to chronic poisoning. Symptoms.—At first lassitude, giddiness and headache, loss of appetite, and a constant metallic taste in the mouth. Afterwards, great muscular debility, a constant desire to vomit, and diarrhoea, with colicky pains. A purple or green line may be present on the gums, and in some cases the hair is said to have acquired a greenish tint. Acute colic, with constipation and local paralysis (symptoms of chronic lead poisoning), are absent in chronic copper poisoning. Treatment.—General, as indicated by the symptoms, and immediate removal from toxic influence.

Contamination of articles of food.—Copper salts have been used to colour pickles, preserved fruits and vegetables, and confectionery. Sulphate of copper also has been added to bread, in order, it is said, to promote the fermentation of the dough, and make the bread whiter. Articles of food are

fatty food materials, boiled and allowed to cool, even in perfectly clean copper vessels, take up copper, but acid food materials, boiled in clean copper vessels and poured out at once, do not dissolve the metal, (4) in all cases the liability to contamination is greater if the copper vessel used is dirty. Copper cooking vessels are frequently tinned inside for protection; the tin used should be free from lead, otherwise chronic lead poisoning may result.

Metallic copper, except in very fine division, may be regarded as inert. Cases of chronic poisoning among copper-smiths, from constantly handling metallic copper, have been reported in England, and also cases among workmen using, as in certain printing processes, copper in a state of very fine division. **Sulphate of copper**, or blue vitriol, *Mora tut* or *Nila tutia*, is readily obtainable in India, and it occurs in blue, efflorescent crystals, which, when heated, lose water and fall into a colourless powder. The salt is very soluble in water, its solution responding to the tests for copper and combined sulphuric acid. Medicinally it is given internally in one-quarter to two-grain doses as an astringent, and in five to ten-grain doses as an emetic. A few cases of its use in India, as a cattle-poison, have been met with. **Subacetate**, artificial verdigris—*Zangul* or *Pitra*. Several subacetates of copper exist, all compounds of normal cupric acetate and cupric oxide. They are blue or green in colour, partly soluble in water, are used as pigments, and appear to be as poisonous as the sulphate. Half an ounce of the subacetate has proved fatal to an adult. Food contaminated with copper, derived from vessels in which it has been prepared or kept, commonly contains copper either as subacetate, or as carbonate (natural verdigris). The subacetate, prepared by boiling or steeping metallic copper in an acetic organic fluid, is a common popular emetic remedy in India in cases of poisoning.

Other copper salts.—Green verditer and blue verditer, both oxycarbonates and Brunswick green, an oxychloride of copper, all used as pigments, are poisonous. So also are the arsenite and aceto-arsenite (see p. 496). The symptoms produced by these last two compounds, however, are those of arsenical poisoning.

Detection.—Copper in minute quantity is nearly always present in the human liver and kidneys, and in the liver and kidneys of domestic animals. Traces of copper have been detected also in wheat and barley, and in a large number of vegetables. Articles of food again, frequently contain copper

in minute quantity as an accidental impurity.¹ Hence the detection of copper in minute quantity in human viscera is quite consistent with death from a cause other than copper poisoning. Solutions containing copper give (1) a dark brown almost black, precipitate, with sulphuretted hydrogen; (2) a blue precipitate with ammonia, dissolving in excess, with formation of a deep blue or purple solution; (3) a blue precipitate with potassic hydrate, insoluble in excess; (4) a chocolate brown precipitate with potassium ferrocyanide; and (5) when slightly acidulated with sulphuric acid, deposit metallic copper on a clean iron

be incinerated,
and the residue

is then filtered and tested for copper as above. Or for quantitative estimation, the solution may be poured into a weighed platinum dish, a piece of metallic zinc added: this dissolves, the copper deposits on the dish as metallic copper, and after washing and drying, may be weighed in this form.

Lead.

Lead poisoning is not common in India. It is usually accidental. It may be acute or chronic. In acute cases the symptoms are those of non-corrosive irritant poisoning, except that there is constipation, not diarrhoea. In chronic cases, much more frequently met with than acute cases, the characteristic symptoms are colic and local paralysis, met with accidentally in painters, typesetters and men in charge of storage batteries.

Acute lead poisoning: symptoms—When a soluble compound, e.g. the acetate, is swallowed, a burning pain in the mouth and throat comes on soon after swallowing the poison, followed by vomiting, and afterwards by colic with constipation. The faeces, if any be passed, are black. Cramps of the flexors follow, and there may be paralysis of the extensors and a blue line on the gums, as in chronic poisoning. Giddiness, stupor, and even coma have been observed. Sparingly soluble com-

but this is not always present. Treatment.—Promote vomiting

or use the stomach-pump, and then give sulphate of magnesia as an antidote. Subsequently, opium may be required to relieve pain, and purgatives to overcome constipation.

Cases—**White lead poisoning by mistake for betel-lime.**—Two cases are reported by Dr. C. L. Bose of poisoning by white lead which was accidentally used by mistake for betel-lime. The poisoned betel was remarked to be bitter in taste and used continuously for three days, on the fourth day severe colic and vomiting occurred, with bleeding from gums but no paralysis. Both recovered. Lead was detected in the urine of one of the men about six weeks after the poisoning—*Calcutta Med. Jour.*, February, 1916.

Chronic poisoning.—May arise from swallowing, inhaling, or external application of lead or its compounds. Hence it is met with in those whose occupation exposes them to constant contact with lead or lead compounds; and is also met with as the result of wilful or accidental contamination of articles of human consumption or use with compounds of lead. In chronic lead poisoning, lead colic, or lead palsy, one or both may be present. **Lead colic, painter's colic, or colica pictorum.**—In this the prominent symptoms are: at first, indigestion, constipation, and feeling of depression, with loss of appetite, thirst, a metallic taste in the mouth, and fetor of the breath. Afterwards there is pain about the umbilicus, usually relieved by pressure, hard, obstinate constipation, and quick, shallow respiration. The urine is scanty, there is a blue line on the gums, and sometimes delirium at night. Vomiting is a common symptom, but febrile disturbance is rare. **Lead palsy.**—This may be the first to appear, or it may follow after one or more attacks of lead colic. It usually commences in the extensor muscles of the hand and forearm, causing **wrist-drop**. Afterwards the muscles of the lower extremities may become affected, and even the muscles of the trunk. As in lead colic, there is a blue line on the gums. Blue line on the gums is believed to be due to a deposition of lead sulphide in the capillaries, and is rarely absent in chronic lead poisoning. A similar line has, however, been observed in chronic poisoning by other metals, e.g. mercury and silver. Other effects of lead on the system are, (1) it checks the elimination of uric acid, predisposing, therefore, to gout, (2) insanity in some cases it is believed, is traceable to chronic lead poisoning, (3) in pregnant females lead poisoning predisposes to miscarriage and it (4) may cause albuminuria.

Chief occupations exposing to risk of lead poisoning are lead miners, smelters, and refiners, plumbers, pipe layers, printers, and type foundry. Lapidaries, barmen, and fishmongers also suffer, the first from handling masses of lead in

which precious stones are embedded while being cut; the second from constantly handling pewter pots; and the third from contact with wet, lead-covered surfaces, on which fish are commonly exposed for sale. Again, cupellers, makers of white and red lead and other lead compounds, painters and dyers, and others using lead pigments, flint-glass makers, and potters using lead glaze, are all liable. Chronic lead poisoning in non-workers in lead is most frequently due to accidental contamination of drinking-water with lead. It may, however, arise from accidental contamination or wilful adulteration of matters other than drinking-water. Contamination of drinking-water.—Pure water has no action on lead if air be excluded; but if air be present, lead hydroxide, slightly soluble in water, is formed. This, by the action of carbon dioxide, becomes converted into a basic carbonate of lead, insoluble in water, but soluble in solution of carbonic acid. The solvent action of water on lead is favoured by the presence of ammonium salts, especially ammonium nitrate. On the other hand, sulphates, phosphates, and carbonates retard or prevent the action. Hence, drinking-waters, free, or nearly free, from ordinary saline impurities, are especially liable to contamination from lead pipes, lead-lined cisterns, etc.

Accidental contamination of other matters.—This may arise from the article having been made, or from its being preserved, in vessels made of or soldered with lead, or in earthenware vessels glazed with lead glaze, or other vessels painted inside with a lead paint. Sometimes the contamination is mechanical in character, assisted, perhaps, by oxidation of the lead: *e.g.* chronic lead poisoning has arisen from the use of flour ground with stones filled in with lead; and from the use of farinaceous foods, or snuff, or tobacco, wrapped in lead foil. In other cases, the contamination arises from a solvent action exerted by the article, such action being specially liable to be exerted by (1) fatty and saccharine matters, and (2) acid matters (except those acid from the presence of sulphuric acid). Thus, milk kept in lead or lead-glazed pans, sugar made in lead vessels, and soup kept in lead-soldered tins, are all liable to contamination. Again, chronic lead poisoning has arisen from drinking cider and beer conveyed in lead pipes, from drinking wine contained in bottles in which shot, used for cleaning them, have been carelessly left; from eating pickles contained in lead-capped jars; and from drinking new rum, contaminated with lead from the lead worm of the distilling apparatus. Old rum, however, is generally free from lead, owing to its precipitation as an insoluble compound, by tannic

acid contained in the wood of the casks in which the rum is kept.

Wilful adulteration, etc.—Acetate of lead has been added to cheap wine in order to sweeten it. Red lead and chromate of lead have been used to adulterate snuff, and to colour articles of confectionery. Chronic lead poisoning has arisen from the use of hair dyes, cosmetics, and lotions, containing lead; and from the external application of white lead as a dressing to a scalded surface.

Chronic poisoning is sometimes met with in India as the result of the contamination of drinking-water, and also as the result of the administration of oxide of lead in quack medicines.

Treatment and prophylaxis.—In chronic lead poisoning the first indication of treatment is immediate removal from the toxic influence. In the case of non-workers in lead, the discovery of the toxic influence is frequently a matter of difficulty, necessitating the analysis of all matters habitually used by the patient. Colic may be treated by a combination of purgatives and anodynes: *e.g.* *Epsom salts* and senna followed by opiates. In both lead colic and lead palsy either soluble sulphates or iodide of potassium may be given, or the two may be combined, each dose of iodide of potassium being followed after an interval of two hours by a small dose of sulphate of magnesia. Workers in lead should be recommended extreme cleanliness, the least possible contact, and the use as a drink of very dilute sulphuric acid. Every precaution also should be taken to remove or keep down lead dust in the workrooms. The following processes have been recommended for the protection of drinking-water conveyed in lead pipes: (1) lining the pipes with tin, and (2) keeping the pipes filled for some time with water containing sulphates, or with a solution of an alkaline sulphide. Where, however, a water is liable to contamination, the use of lead pipes, lead-lined cisterns, etc., should be entirely avoided.

Metallic Lead is generally regarded as powerless to cause

lead, the lead in this case acting as a mechanical irritant. Chronic cases, due to the action of metallic lead, are often met with.

Soluble Lead Salts.—(1) **Acetate of lead**, sugar of lead.—This is a white crystalline salt, very soluble in water, sparingly soluble in alcohol, and insoluble in ether; heated, it chars, yielding no sublimate. It is not very poisonous, and has been given

in divided doses to the extent of eighteen grains, or even more, daily for a week or ten days without ill effect. The same quantity in minute doses, spread over a longer period, would be far more likely to cause serious symptoms. One ounce has

atmospheric carbon dioxide. Its action is similar to that of the acetate (3) **Nitrate of Lead** a white crystalline salt, very soluble in water, but insoluble in alcohol, is probably as poisonous as the acetate.

Sparingly Soluble or Insoluble.—(1) **Litharge**—Monoxide of lead, *Mussicot.*—*Murdasang*, yellow or reddish-yellow in colour, is slightly soluble in water. Two tablespoonfuls of it have been swallowed without ill effects. Chevers, however, mentions two cases of chronic poisoning, arising from its use by quacks in India as a cure for syphilis. In one, serious symptoms came on after swallowing twenty-five grains daily (mixed with white sugar) for five days. In the other, two *sowars* (troopers) suffered from lead colic, after swallowing on each twenty grains of *lochan* (tabashir).

ing 2½ ounces. In this case no symptoms appeared for nine hours. Red lead (in the Bombay Presidency, and possibly in other parts of India also) often forms an ingredient of the paste used for arming abortion-sticks (see p. 314). In a case recently tried in Bombay, a woman, a professed abortionist, convicted of causing miscarriage, was found to have in her possession a number of sticks so armed. Red lead, alone or mixed with arsenious oxide, is sometimes in India employed as a cattle poison. $PbCO_3$ containing a insoluble in water, but so acute poisoning by it in a child *at* five, is mentioned by Taylor. In this case, although no urgent symptoms were present for three days, the child died in ninety hours.

(4) **Chloride of lead, $PbCl_2$** , boiling water, has in one case—oxychloride is also met with, us—

Alkaline and Earthy Salts.

Certain alkaline and earthy salts, poisonous only in large doses, may conveniently be considered under this head. Cases of poisoning have been reported from large doses of the following :—

Sodium chloride, Common Salt.—This, in large doses, acts as an irritant poison. Half a pound has caused death, with symptoms of irritant poisoning followed by paralysis. **Potassium nitrate, Nitre, Saltpetre, sal prunelle, Sorakhara,** in doses of an ounce or more, has, in several instances, caused death. In one case, however, recovery took place after swallowing six ounces. When swallowed in poisonous doses, besides acting as an irritant, it acts remotely on the nervous system, causing great prostration of strength, and, in some cases, convulsions and partial paralysis. Suppression of urine also has been observed. In some of the fatal cases death has

Potassium
in children,
and collapse,

and in adults to nephritis. One ounce may be regarded as a fatal dose for an adult, and two drachms has caused death in children. **Acid potassium sulphate, bisulphate of potash, sal polychrest, sal do duobus,** in large doses, acts as an irritant poison; ten drachms has caused death in two hours. The salt, in some countries, is popularly believed to possess the power of causing abortion, and fatal cases have arisen from its employment with this object. It is liable to contain as impurities sulphate of zinc and arseniate of potash. **Potassium bitartrate** (see 'Tartaric Acid'). **Common or potash Alum, Phatki.**—This also, in large doses, acts as an irritant poison, and has, in one or two cases caused death. Burnt alum, or alum depr
slight caus
Christison

A boy, aged ten, was given by his father two ounces of Epsom salts in a teacupful of water as a laxative. The boy died of collapse within an hour; there was no vomiting or purging. Another point of medico-legal interest attaching to this salt is the close resemblance its crystals bear to those of oxalic acid and sulphate of zinc.

Mechanical Irritants.

Under this head may be classed all substances which are liable, when swallowed, to cause symptoms of irritant poisoning.

solely in consequence of their mechanical action on the parts with which they come in contact.

Many definitions of the term 'a poison' exclude such substances. As already pointed out, however, the question whether or no such substances may properly be called poisons, is for medico-legal purposes in India a matter of little importance. In India, in fact, when it is alleged that an individual has committed an offence by administering or attempting to administer one of these substances, *e.g.* pounded glass, the questions which a medical expert has to consider are (1) What has been the effect of the administration of the substance? and (2) Is the substance one which it is 'deleterious to the human body to swallow,'¹ or an 'unwholesome thing'?² and not, Is the substance 'a poison'?

Substances which, when swallowed, may act as mechanical irritants, are: (1) Hard, sharp, angular or pointed solid matters, *e.g.* pounded glass, pins, and needles (see also 'Salicylic Acid,' 'Arums'), and seeds and stones of fruit; (2) Substances which swell largely; and (3) Liquids at a or melted lead. Of these —

Pounded glass.—This, in many parts of India, is popularly believed to be a very active poison, and has been used both in attempts at suicide and attempts at homicide. The Bombay Analyzer's records for the ten years ending 1884 show that during that period, this substance only was detected in thirty-one cases of alleged attempted human poisoning. In twenty-three of these it was detected in bread, sweetmeat, or some other article of food; in three more in vomited matters, two of these being cases of attempted suicide by females; in one case it was found after death in the contents of the stomach of a man (*Case* below); in another in some pills: and in the three remaining cases pounded glass, *per se*, was sent for identification. In nearly all these cases, the glass found was coloured glass, resembling fragments of bangles; and in two only it was reported that the individuals suspected of having used the glass with criminal intent were males. Five cases,³ all from the Central Provinces, were of alleged attempted homicide, by pounded glass, all being alleged attempts by wives to poison their husbands; and Chevers⁴ mentions a case brought to the notice of the Chemical Examiner, Bengal, in which a servant attempted to poison his master by pounded glass introduced into a mess of spinach, and also a Bombay case, in which a

¹ *Ind. P. C.*, ss. 324, 326.

² *Beng. Medico-legal Rept.*, 1870-72, p. 292.

³ *Ib.*, s. 323.

⁴ *Med. Jur.*, p. 287.

man seized in the act of committing a robbery, attempted suicide by swallowing fragments of a wine bottle.

The more finely the glass is pounded the more likely are the particles to become completely enveloped in mucus, etc., and to be thus prevented from injuring the mucous membranes. Hence, as the ill-consequences arising from swallowing pounded glass are solely due to the mechanical injury it inflicts, the more finely it is pounded the less likely is swallowing it to cause harm. Considerable quantities of pounded glass, in large angular fragments even, have often been swallowed without ill effects being produced. On the other hand, cases are recorded where swallowing pounded glass has caused symptoms of irritant poisoning (see *Cases* below), and there is reason to suppose that, in exceptional cases, swallowing pounded glass may even cause death (see *Cases* below). In Europe and America it is also employed for homicidal and suicidal purposes. By experiment Lo Sauvage¹ found that 2½ drachms of pounded glass could be given to a cat without injury, and a dog took 6 ounces in 8 days without any obvious symptoms, and Lo Sauvage himself swallowed a considerable number of the particles without inconvenience following

Case—Homicidal poisoning by pounded glass.—In 1807 two cases of

a man by his wife, the powder having been obtained by pounding her bangles

Cases—Poisoning by pounded glass.—(a) (Christison, *Poisons*, p. 654).—Portal relates a case of a man who undertook for a wager to eat his wine-glass, and actually swallowed part of it. He was attacked

recovered.

Cases—Poisoning by broken glass.—(a) (Christison, *Poisons*, p. 653). In a case which occurred in Paris a woman, after a hasty dinner, became unwell, and next morning was seized with violent pain in the stomach and vomiting, and died in convulsions. Forty-two days after her death her body was exhumed; black points and patches were found in the bowels, together with a quantity of broken glass. The medical witnesses differed as to the cause of death. (b) (*Ibid.*, p. 654).—In a case

¹ In Paris in 1820. *Edinb. Med. Surg. Jour.*, 1824, p. 225

published by Mr. Hobb, a child, eleven months old, died of a few days' illness in very suspicious circumstances. On *post mortem* examination the inside of the stomach was found lined with a tough layer of mucus streaked with blood. The villous coat was highly vascular, and covered with num-

not repose. A quantity of powdered glass was found in contents of the stomach. No irritant substance other than pounded glass could be found in the viscera.

Treatment.—This should consist in the administration, first of bulky food so as to envelop the fragments, and then of emetics and laxatives.

Diamond dust.—Diamonds and diamond dust are popularly believed in India to be very poisonous. Thus, in the Baroda case (p. 486), a mixture of arsenious oxide and diamond dust was employed, and Chevers¹ mentions two Indian cases of attempted suicide by swallowing an unbroken diamond. Like pounded glass, any injurious action possessed by diamonds or diamond dust is solely mechanical.

Chopped hair.—This also may act as a mechanical irritant. Chevers² mentions that a belief exists in some parts of India that 'tiger's smellers' are poisonous, and states, on the authority of Baboo Kanny Lall Dey, that chopped hair is sometimes used by cattle poisoners. Dense concretions of felted hair are sometimes found in the intestines of ruminants. Their shape is rounded, sometimes the surface is smooth, hard, and shiny, almost spherical, and they may be a little more than an inch in diameter. They are formed from hairs swallowed by the animals when licking themselves. These concretions have occasionally been mistaken for foreign objects administered with intent to poison the animal.

¹ *Med. Jur.*, p. 239.

² *Ibid.*, p. 221.

CHAPTER XXVI.

VEGETABLE IRRITANTS.

A LARGE number of plants yield matters capable of acting as irritant poisons. Some of these are simple irritants, possessing little or no remote specific action on the nervous system. Others are compound irritants, causing, in addition to irritation, cardiac depression, *e.g.* squills and *gloriosa superba*; or acting on the brain and spinal cord, *e.g.* *cocculus indicus*. A few owe their activity to the presence of an alkaloid or vegetable base, *e.g.* *stavesacre* and the *veratrum*s; these may be called 'alkaloidal

termination *in* denotes a non-alkaloidal substance, *e.g.* picrotoxin, plumbagin.

Alkaloidal Irritants.

The detection of these and other alkaloidal poisons mainly depends on the elimination of the alkaloid, and its recognition by chemical or physiological tests. The elimination of alkaloids from organic mixtures is generally effected by a modification of Stas-Otto process as elaborated by Dragendorff.

Dragendorff's process for the separation of plant principles from organic mixtures is in outline as follows. The process essentially consists in—

A. Preparing an acid watery solution of the matters under examination, by digesting the finely divided matters with water acidulated with sulphuric acid, filtering, pressing, and twice repeating the digestion. The filtrates are mixed, evaporated to a syrup, and this is macerated for a day with four volumes of alcohol, filtered, and the residue washed with spirit. The alcohol is then driven off by evaporation from the alcoholic filtrate, water (if necessary) added, and the liquid filtered again.

B. Extracting the whole still acid by agitation with (1) petroleum ether, (2) benzene, and (3) chloroform. The solvents are to be used in the order named, and each after use separately evaporated in small portions in small dishes. C. Saturating the acid watery solution with ammonia (previously removing any residual chloroform by agitation with petroleum ether) and extracting the ammoniacal fluid as in B with, in succession, (1) petroleum ether, (2) benzene, (3) chloroform, and (4) amyl alcohol; and finally (5) drying up the ammoniacal fluid by evaporation with powdered glass, and extracting the dry residue with chloroform. The table here given shows the principal substances likely to be found in the various residues. Non-poisonous substances are mentioned in brackets thus (Thiène)†.

Solvent	B Residues from acid fluid	C Residues from alkaline fluid
1. Petroleum ether	Piperine, picric acid, carbolic acid, camphor, and capsaicin	Liquid volatile alkaloïds and aniline, also strychnia, brucia, veratria, emetine, and (quinine)
2. Benzene	Cantharidin, santonin, digitalin, and (thiène), elaterin, colocynthin, colchicin and absinthin	Strychnia, atropia, and hyoscyamino; also (quinine, cinchonino, and narcotine), brucia, physostigma, veratria, aconitia, and emelina
3. Chloroform	Picrotoxin, helleborin (cinchonine), digitalin, saponin, and jervine	Morphia (and cinchonine)
4. Amyl alcohol	—	Morphia, solanino, saponin, salicin
5. Chloroform	—	Curarino

The Stas-Otto Process for Isolating Alkaloids.

As modified by Dr. E. H. Hankin.

This 'Stas-Otto' process as elaborated by Dragendorff is, however, far too elaborate for an Indian Chemical Examiner who may have to deal with half a dozen cases of poisoning per day, and who, outside of the Presidency towns, but rarely has to test for more than a few of the common poisons.

The advice that has been given that all basins, beakers, etc., used in the test should be new, is obviously a counsel of perfection that can scarcely be carried out in practice. Sufficient protection against contamination will be obtained if care is taken that all articles used in the tests are washed in running water immediately after use. If for any reason viscera, etc., have to be left in bottles or beakers for a long time so that organic deposits are formed in their interior, it is advisable that

† For details of the process, see Dragendorff on Organic Analysis.

after a preliminary washing, they should be left full of water for several days. The effect of the resulting putrefactive processes is usually to loosen the deposits so that they can be readily removed. A hot solution of such soap preparations as Hudson's Extract or Lux, is often useful in the final cleaning of glass apparatus. Hot water is necessary for removing the last traces of these soap solutions from the glass.

The Stas-Otto process may be carried out as follows:—

(1) The viscera are usually received preserved in alcohol. During the time that elapses between the placing of the viscera in alcohol and their examination in the Chemical Examiner's laboratory, any alkaloids present will have commenced to pass into solution. The quantity of alcohol that has been used as preservative is usually equal in bulk to the viscera. The bottle or jar containing the viscera should be only two-thirds full. That is to say, one-third of its contents is occupied by viscera one-third by the added alcohol, and one-third remains full of air. The object of this is to avoid risk of bursting the bottle in case any gases are given off. The free space also has the advantage that the viscera are well shaken while en route, thus aiding the penetration of the alcohol.

The viscera should be cut up into small pieces, and placed in a large beaker with the alcohol in which they have been preserved.

(2) Boil the portion of the viscera destined for the Stas-Otto process in the above beaker, after the addition of a few drops of acetic acid. This is done by standing the beaker on a water-bath. In cases of suspected aconite poisoning, it is advisable not to heat the viscera above 65° C.

(3) Filter. Most of the alkaloids present are thus obtained with many impurities in a clear solution in the alcohol. The viscera remaining on the filter should be again extracted with alcohol. This second portion of alcohol should be filtered off and added to the first portion.

(4) These mixed filtrates should be evaporated nearly to dryness. The evaporation should be carried out over a water-bath in a current of air. That is to say, for this purpose, a closed stink-cupboard is not so suitable as a room attached to the building by only one side and the area of whose walls is chiefly occupied by wire gauze, and in which arrangements are made for the gas burners to be enclosed in cupboards below the level of the working benches. The wind blowing through this room is far more efficient in promoting evaporation, and removing smelling substances, than any arrangement of flues or vacuum arrangement obtainable in practice.

(5) When the above filtrate has been evaporated to syrupy

consistency, add about 20 c.c. of water, while stirring, and filter. A piece of ordinary thin filter paper and a funnel should be used for this purpose. Attempts to hasten filtration by means of a suction pump result in loss of time. In the rare cases in which the liquid refuses to filter easily, centrifuging may be employed instead of filtering.

(6) Place this watery extract in a separating funnel. Add a small piece of litmus paper. See that the reaction is acid. Should this not be the case, acidify with acetic acid. Add 50 c.c. of ether. Shake violently for one minute.

(7) Fix the separating funnel in a stand, and allow it to rest for at least an hour. By this time the ether will usually have formed a separate layer floating on the surface of the watery liquid. If the two liquids have not separated, sometimes addition of a small quantity of plaster of Paris and gentle shaking, followed by another rest, will cause separation. But a far superior method is to use a centrifuge. The small hand or electrically driven centrifuge used in bacteriological laboratories is useless for this purpose. A large and powerful centrifuge is necessary. Before placing in the centrifuge the tube containing the mixed liquids and its holder must be placed in one pan of a balance. Another tube and holder is placed in the opposite pan, and water is poured into this second holder until the two tubes balance exactly. The two holders are then placed opposite each other in the centrifuge.¹ If the two holders are not *exactly* balanced in this way undesirable and even dangerous strains are introduced. In order to be sure that the two holders are of the same weight a somewhat sensitive balance of good quality should be employed. Usually five minutes' centrifuging at full speed is sufficient. Occasionally a longer time is advisable. When the machine comes to rest, the liquids will be found to have separated. Sometimes a dense layer of glutinous matter will be found between the ether and the watery layer. This may be so dense that it is possible to invert the tube and pour off the

and it becomes broken up in the liquid the two liquids will not readily separate.

(8) When the liquids have separated, hold the separating funnel with its stem in the mouth of a second separating funnel. Open the tap and allow the watery liquid to flow into the lower funnel. The ethereal layer (the acid ether extract) contains impurities, and may contain certain poisons that do not generally have to be tested for in Indian practice, and may therefore be thrown away. If the ethereal layer is strongly coloured, it is advisable again to treat the acid liquid with ether. Further washings with ether followed by repeated washings with chloroform are desirable when testing for certain poisons such, for example, as strychnine. If chloroform is used, it is best shaken with the acid liquid with the help of a shaking machine. If the above-mentioned glutinous layer has been completely removed, the chloroform should separate easily. Otherwise further centrifugalization may be required.

(9) The more common alkaloids are retained in the acid watery liquid in the lower funnel. Add to this about 2 c.c. of chloroform and a piece of litmus paper. Then add 50 c.c. of ether. Shake. Add sufficient ammonia to change the reaction to alkaline. Then, at once, shake violently for at least half a minute. The reason for shaking at once after the addition of the ammonia is that at the moment of liberation by ammonia the alkaloids present are in a condition in which they can, in most cases, pass readily into the chloroform ether mixture. After the lapse of a few minutes they become changed and pass into solution in the ether less easily.

(10) Place the separating funnel in a stand. Allow it to rest for some time, preferably till next day. In rare cases it may be necessary to centrifugalize.

(11) The liquid will now have separated into two layers. The upper ethereal layer contains most of the alkaloids. This is called the 'alkaline ether extract.' The lower watery layer contains impurities, and in cases of opium poisoning will contain morphia and the substance giving the 'meconic reaction.'

(12) Tap off the watery liquid. See that the piece of litmus paper in the separating funnel is blue.

(13) Pour off the ethereal liquid through the mouth of the funnel into a porcelain basin. If traces of the watery liquid come with the ether they will soon settle to the bottom of the porcelain basin, and in this case the ether must be poured from the first into a second basin in order to leave these watery impurities behind.

(14) Add to the ether in the basin a few drops of a $\frac{1}{2}$ per cent. solution of acetic acid in water.

(15) Evaporate on a water-bath, preferably under a small rotary fan until only two or three drops of the dilute acid are left. It is preferable (especially in cases of aconite poisoning) that the water-bath should be heated to something less than the boiling point, and allowed to cool further as evaporation proceeds. The evaporated dilute acid may now be tested for different alkaloids.

(16) The watery liquid of (11) is now made acid and heated. While hot an equal volume of amyl alcohol is added. The liquid is made alkaline with ammonia, and the mixed liquids are violently shaken. Morphia, if present, passes into the amyl alcohol.

(17) The watery liquid separated from (16) may now be subjected to the *meconic test*.

Special Alkaloidal Irritants.

The chief alkaloidal irritants are Stavesacre, Aconite, Sabadilla, Hellebore, Colchicum, Laburnum, Emetine, and Apomorphia.

Ranunculaceæ.

Stavesacre—*Delphinium Staphysagria*.—The seeds of this plant

motor nerves like curare; and
 mainly to aconitine, paralyzing
 other poisons belonging to
 and 'Aconite' (see 'Cardiac

Melanthaceæ.

Cevadilla or Sabadilla—*Asagrea officinalis*, *Veratrum officinale*, *Sabadilla officinarum* or *Schœnocraulon officinale*.—From the fruit and seeds of this plant the poisonous alkaloid, or mixture of alkaloids, used in medicine under the name of *veratrin* or *veratrine*,¹ is obtained. This is an active poison. The medicinal dose is one-twelfth to one-eighth of a grain. In over-doses it causes violent sneezing, and the usual symptoms of irritant poisoning coupled with great depression of the action of the heart and collapse. Veratrin also first stimulates and then paralyzes the peripheral extremities of the sensory nerves; hence a peculiar pricking sensation followed by numbness is one of the symptoms of poisoning by it. In cases of poisoning by veratrin, this pricking and numbing sensation is said to be more felt in the fingers and toes and in the joints than in the tongue; while in cases of poisoning by aconite,

¹ Commercial veratrine has lately been found to consist mainly of two alkaloids, veratrine and cevadine, both powerfully sternutatory.

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Ranunculaceæ.

Stavesacre—*Delphinium Staphysagria*.—The seeds of this plant have an acid taste, and from experiments on animals have been ascertained to act as a compound irritant poison, their special remote action being to cause cardiac depression, and paralysis of the respiratory movements. They contain several alkaloids, of which the two most important motor nerves like curare; and largely to aconitine, paralyzing other poisons belonging to and 'Aconite' (see 'Cardiac

Melanthaceæ.

Cevadilla or Sabadilla—*Asagrea officinalis*, *Veratrum officinale*, *Sabadilla officinarum* or *Schœnocraulon officinale*.—From the fruit and seeds of this plant the poisonous alkaloid, or mixture of alkaloids, used in medicine under the name of *veratrina* or *veratrine*,¹ is obtained. This is an active poison. The medicinal dose is one-twelfth to one-eighth of a grain. In over-doses it causes violent sneezing, and the usual symptoms of irritant poisoning coupled with great depression of the action of the heart and collapse. *Veratrina* also first stimulates and then paralyzes the peripheral extremities of the sensory nerves, hence a peculiar pricking sensation followed by numbness is one of the symptoms of poisoning by it. In cases of poisoning by *veratrina*, this pricking and numbing sensation is said to be more felt in the fingers and toes and in the joints than in the tongue; while in cases of poisoning by aconite,

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which has a similar effect on the sensory nerves, the pricking and numbing sensation is more felt in the tongue. The seeds contain about 0.3 per cent. of veratria. **Detection.**—Veratria may be extracted from organic mixtures by Stas' process, and recognized by the following special tests. (1) It excites violent sneezing. (2) Strong hydrochloric acid dis-

quid becomes
low solution,
on the addi-
ple colour is

produced

White hellebore, or *Veratrum album*, and *Veratrum viride*, American or green hellebore. The rhizomes or root-stocks of these, and of other species of veratrum, cause symptoms similar to those caused by veratria. Twenty grains of white hellebore root has caused death, and probably less would prove fatal. Green hellebore root, official B.P. and I.P., is

except
edical

acid, the two last giving colours very similar to veratria, while jervine and pseudo-jervine give a yellow changing to yellow-brown, and after a time to green, the green tint becoming more developed on dilution.

Colchicum autumnale, or Meadow Saffron.—The whole of this plant, a native of Europe, is poisonous, owing to the presence of colchicine, a nitrogenous substance classed by some chemists as an alkaloid. The corn and seeds are used in medicine chiefly in the treatment of gout, and are a constituent of quack remedies for gout.

In over-doses,
domen, violent
tant poisoning,
unaffected. In

Post mortem

appearances—After death the stomach and intestines are usually found

B.P. and I.P. in addition contain an extract, and an acetic extract of the corn, dose $\frac{1}{2}$ to 2 grains; also a wine prepared from the corn (strength 1 to 5), and a tincture of the seeds (strength 1 to 8), dose of either 10 to 30 minims. In two cases a quantity of tincture equal to 48 grains of the dried corn caused death. This is the smallest fatal dose on record. More than one case of recovery after swallowing one ounce of the wine has been reported. **Treatment.**—The general treatment of irritant poisoning, with free administration of decoctions containing tannin. Stimulants in form of brandy by the mouth (or if vomiting is present other injections) should be given to

it exudes a milky juice, its taste is bitter and acid. The seeds are reddish-brown externally, white within, spherical, and about one-tenth

of an inch in diameter. For the separation of colchicine from organic mixtures, Stas' process may be employed, using chloroform as a solvent. Colchicine differs from alkaloids, in being removed from acidulated watery solution by agitation with chloroform, hence the acid watery filtrate obtained in Stas' process may first be shaken with petroleum ether, in which colchicine is insoluble, to remove impurities, and then without neutralization with chloroform. Colchicine, unlike alkaloids also, is not precipitated by mercuric potassium iodide solution. The special chemical test for colchicine is Zensels'; when a dilute solution of colchicine is boiled with ferric chloride it becomes green, sometimes dark green and cloudy, and if the fluid be then agitated with chloroform the chloroform will sink, taking with it the colouring matter and

trustworthy for colchicine, a French committee of experts concluded that "experiments on animals do not afford the means of determining that poisoning by colchicine has taken place." Ogier obtained the reactions of colchicine isolated by the usual process from the exhumed bodies of dogs which he had poisoned with it five and a half months before. In the bodies of animals poisoned with it, Obolonski detected colchicine four and a half months after death¹.

Hermodactyl, Surinjan.—Under the name of *surinjan* two kinds of *hermodactyl* are sold in the bazaars of India, *surinjan-t-shirin* or tasteless *hermodactyl*, and *surinjan-t-talkh* or bitter *hermodactyl*. Both varieties of *hermodactyl* are corns, more or less resembling colchicum corns. Of the two the tasteless variety appears to be nearly inert, while the bitter variety acts like colchicum, though doubtfully poisonous. It is the corn of *Colchicum luteum*, growing in Cashmere; and the sweet variety, the corn of *Merendera persica*. Dymock² notes that the sliced bulb of the true narcissus (*N. Tazetta*) is sold in Bombay as bitter Surinjan, but that it may be detected by its larger size and tumescent structure. Its action is similar to that of other species of narcissus (see *Amaryllidæ*).

Leguminosæ.

There are several poisonous peas in India. (**Laburnum**) *Cytisus Laburnum*.—All parts of this plant, common in Europe, are poisonous. Several cases of poisoning by it, mostly accidental, have occurred in England. The usual symptoms of laburnum poisoning are vomiting and purging, followed by drowsiness and insensibility, with muscular twitchings and dilated pupils. Its active principle is the alkaloid cytisine. Cytisine is said to be the active constituent of Persian and Australian insect powder. **Broom.**—*Cytisus scoparius vel Spartium scoparium*.—The tops of this plant, also a native of Europe, are official in the B.P. and I.P. In large doses they cause vomiting and purging. They contain a crystalline non-poisonous substance, scoparin, and the poisonous liquid volatile alkaloid sparteine, the action of which is identical with that of coma, a similar alkaloid contained in conium maculatum, which see.

¹ Dixon Mann, *For. Med.*, 619

² *Mat. Med.*, p. 637.

Other Irritant Alkaloids.

Emetine.—This is the alkaloidal active principle of ipecacuanha, and is an irritant to the gastric mucous membrane, rapidly causing vomiting; it is also a cardiac depressant.

Apomorphine.—This is an artificial alkaloid, prepared by heating morphine with hydrochloric acid. It is the most active emetic known; one-tenth to one-quarter of a grain of the hydrochloride of apomorphine by the mouth or one-twentieth grain to one-tenth grain hypodermically injected, rapidly causes free vomiting, and may be employed to excite vomiting in cases of poisoning, especially where the gullet is obstructed.

In cases of poisoning by the alkaloidal irritants (and by alkaloids generally) administration is indicated of gallic acid, or tannin or decoctions containing tannin. These form insoluble compounds with alkaloids. Or animal charcoal, which removes alkaloids from solution by adhesion, may be given with a similar object.

Non-Alkaloidal Vegetable Irritants.

The great majority of these do not contain any substance capable of detection by chemical processes. Hence, many can only be recognized by their botanical or physical characters. A few, however, contain matters separable from organic mixtures by chemical processes and capable of identification by chemical or physiological tests. When such matter is a *glucoside* or other crystalline substance, its separation may, in

(see 'Picrotoxin' and 'Plumbagin').

Anacardiaceæ.

Marking-nuts, Bhela, Bhilawa (Hind.), Bibba (Bomb.), Shen-kottai, Sherankottai (Tam.), the fruit of the *Semecarpus Anacardium*. Marking-nuts appear to be seldom, if ever, in India, given internally as a poison. The bruised nut, however, is used as a local irritant application for the purpose of procuring abortion; and the juice, like vitriol in England, is thrown over the body to cause injury. A case of this last kind

terminating fatally, where marking nut juice mixed with other irritants was employed, is recorded.¹ Again, in a case tried before the High Court, Bombay, a Hindoo was convicted of causing hurt to his wife by throwing marking-nut juice over her face, blistering of the skin and severe ophthalmia of one eye, lasting several days, being the result. Marking-nut juice is also used by malingerers for the purpose of producing ophthalmia and skin eruptions, and Dr. W. Gray once met with a case where a man introduced three marking-nuts into his wife's vagina, apparently as a punishment for infidelity.



FIG. 31.—Marking-nuts.

The juice, more or less diluted, is said to be used as an application to the skin for the purpose of imitating bruises in support of a false charge.²

IDENTIFICATION.—Marking-nuts, in the dry condition in which they are usually met with, are black in colour and more or less heart-shaped, with a rough projection at the base (see Fig. 31). They measure, excluding this projection, in longest diameter from about 7 to 11-tenths of an inch, and weigh from about 25 to 55 grains each. They have a thick cellular pericarp, the cells of which contain the irritant juice. Inside the

according to Basiner, when subcutaneously injected in large doses, causes, in warm-blooded animals, stupor and paralysis. Marking nut juice may be recognized by (1) its solubility in alcohol, ether, and oils; (2) its vesicating action on the skin; and (3) if a few drops of an alcoholic

¹ Basiner, quoted by Dymock, *Mat. Med.*, 2nd ed., p. 204.

² *Op. cit.*, p. 203.

solution of the juice are placed in a porcelain dish, and a drop of solution of potassic hydra produced, which, to reddish-brown. oil, and used with before it begins to act. Testing in this way some of the fluid used in the Bombay case mentioned above, no effect was noticed for forty-eight hours, after which a painful and very persistent eruption was produced.

The fruits when bruised yield a brown, highly acrid, oily juice, turning black on exposure to the air. This juice, when applied to the skin, vesicates strongly, raising black blisters, containing a fluid which causes an eczematous eruption on any part of the skin it comes into contact with. Internally administered, the juice appears to be much less actively irritant than it is when externally applied. According to Dymock,¹ the juice of one nut mixed with a seer of milk is an ordinary internally administered dose in native medical practice; and Mohammedan writers speak of 12 to 24 grains of the juice, given in oil or melted butter, as an ordinary medicinal dose, and of 2 dirhems (= 96 grains) as a poisonous dose.

Cashew-nuts, *Kaju* (Hind., Mar., Bomb.), *Kottai-mundiri* (Tam.), *Hyli-badam* (Beng); the fruit of *Anacardium occidentale*.—The pericarp of the Cashew-nut contains a brown acrid juice of similar composition and properties to marking-nut juice. Its alcoholic solution, however, treated with potassic hydrate solution, turns reddish-brown, and not bright green, like an alcoholic solution of marking-nut juice. Cashew-nut juice appears to be seldom, if ever, used criminally in India. The kernel of the nut is non-acrid, and is eaten raw, or more usually slightly roasted, or cooked.

Rhus.—Some species of juice possessing irritant juice. Exposure producing symptoms.

radicans, poison-oak • *Rhus toxicodendron*.

yielding a similar acrid

Linn.), *Tatree* (Hind.), *Akkol rikul* (Panj.). Regarding *R. Toxicodendron* and other species see:—J. C. White's *Dermatitis Venenata*, 1887

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to Billet on Dermatitis from

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The China Med. Missy. Journ.

vol. viii. No 2, June, 1894; also Mathews in September number. Nicholson of Kew Royal Gardens has known several cases. Several

¹ Dymock, *op. cit.*, p. 203, and *Ind. Med. Gaz.*, Aug., 1900

² *For. Med.*, p. 232.

³ *Plants of Sind*, p. 86.

species give rise to acute inflammation of the skin, the so-called *dermatitis tencnata*. The itching and burning and inflammation may be alleviated by saturated solution of boric acid or sedatives.

Oleacea.

Wild olives possess an irritant principle which has proved to be poisonous

Case.—Wild olive poisoning.—The Civil Medical Officer of Kurseong sent some wild olives preserved in lime-juice, which a Eurasian boy, fifteen years old, belonging to the Victoria School at Kurseong, ate on the 15th November. The boy was taken ill on the 16th with acute vomiting, and died on the 17th. Other boys were reported to have eaten the same olives without ill effects. The olives were found to possess irritant properties. A small quantity of the extract of the olives was administered to a cat. The animal vomited several times, but ultimately recovered. The nature of the irritant principle could not be determined.—C. L. Bose, *Beng. Ch. Ez. Rept*, 1907.

Asclepiadææ

Madar.—*Calotropis gigantea*, Brown (vel *Asclepias gigantea*, Willd.), *C. procera*, Brown (*C. Hamiltonii*, Wight), *Ak*, *Madar* (Hind), *Akanda* (Beng.), *Akra*, *Rui* (Bomb.), *Erukku*, *Erukam* (Tam). These two shrubs closely resemble one another, and are known by the same vernacular names. One or other of them is found growing wild almost everywhere in India. The leaves and stalks, when incised, yield an acrid milky juice, used in native medicine as an external application in cutaneous affections and as a depilatory. The fresh or dried juice, or the root bark, is also given internally as an alterative or purgative. An ordinary medicinal dose of the powdered root bark as an alterative is 3 to 10 grains three times a day. In doses of 30 to 60 grains the root bark acts as an emetic, and has been used as a substitute for ipecacuanha.

In India *madâr* juice appears to be used criminally, chiefly for purposes of infanticide, and as an abortifacient, more rarely for suicide and still more rarely for homicide. According to Chevers and others, forcing *madâr* juice down the throat is the method of infanticide employed by the castes among which female infanticide prevails. *Madâr* juice is also given internally, and applied locally, for the purpose of causing abortion. The leaves have also been administered for criminal purposes with food. It is also used as a cattle poison.

The active principle appears¹ to be a yellow bitter resin, besides which the root-bark also contains two substances named

¹ Warden and Waddell in *Pharm Journ*, August 22, 1855.

solution of the juice are placed in a porcelain dish, and a drop of solution of potassic hydrate is added thereto, a bright green colour is at once produced, which, on rolling the fluid about in the dish, rapidly changes to reddish-brown. When applied to the skin it should be diluted with oil, and used with caution. When applied diluted it may be some time before it begins to act. Testing in this way some of the fluid used in the Bombay case mentioned above, no effect was noticed for forty-eight hours, after which a painful and very persistent eruption was produced.

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(Tam.), *Ḍ*
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Rhus.—Some juice possessing ir
juice. Exposure
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radicans, poison-oak or poison-ivy; *Rhus vernix*, poison-Sumach, *Rhus toxicodendron*. Among the plants of Sind, Murray² mentions as yielding a similar acrid juice, *Rhus acuminata* (syn. *Rhus succedanea*, Linn.), *Tatree* (Hind.), *Arkkol rukul* (Panj.). Regarding *R. Toxicodendron* and other species see:—J. C. White's *Dermatitis Venenata*, 1887

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The active principle appears¹ to be a yellow bitter resin, besides which the root-bark also contains two substances named

¹ Warden and Waddell in *Pharm. Journ.*, August 22, 1883.

by Warden and Waddell,¹ 'madár-alban' and 'madár-fluavil,' closely resembling the alban and fluavil found in gutta-percha. It contains no alkaloid.



FIG. 32.—*Calotropis gigantea*—Stem, Leaf, and Flower $\frac{1}{2}$.

Case.—**Cattle Poisoning by madár.**—In 1896 a piece of cloth, stiffened with a sticky substance alleged to be *madar* juice and taken from the stomach of a cow, was sent for examination. An alcoholic extract of the rag was given to a cat, which died within half an hour. The symptoms noticed were:—Vomiting, profuse salivation, severe tetanic convulsions, extremely slow and stertorous breathing and dilation of the pupils.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

¹ Warden and Waddell in *Pharm. Journ.*, August 22, 1885

Identification.—The root bark (official I. addn to B.P.) occurs in short, flat or arched pieces $\frac{1}{4}$ th to $\frac{1}{2}$ th of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured lengthwise, and can be
 1 is white, mealy,
 1 is mucilaginous,
 s. 32 and 33 show
 v. of *C. gigantea*.

Drury describes the flowers of *C. gigantea* as rose-colour and purple mixed, and those of *C. procera* as pale purple.

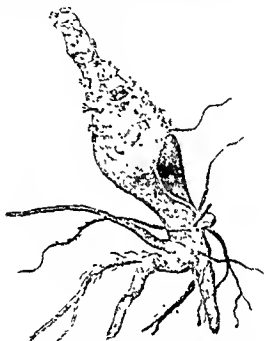


FIG. 33.—*Calotropis gigantea*—Root $\frac{1}{2}$.

Cryptostegia grandiflora*, Syn. *Nerium grandiflorum (see Fig. 34).—This is a climbing plant belonging to the N.O. *Asclepiadaceae*. The stalk yields a milky juice, which, when dried, solidifies into a substance resembling india rubber. One fatal case of poisoning by this plant has been reported as follows.—

Case.—**Poisoning by *Nerium grandiflora*.**—The pounded leaves mixed with water were swallowed. Persisting vomiting came on half an hour afterwards, and the patient—a male adult—died in fifteen hours, apparently from exhaustion. There was no purging, and no head symptoms were present. No alkaloid could be found in the leaves.

Tylophora fasciculata*, vern. *Bhus-dori (see Fig. 35).—This plant is abundant in the Southern Konkan, where it is used as a rat poison. One homicidal case of poisoning by administration of the pounded roots in

by Warden and Waddell,¹ 'madár-alban' and 'madár-fluavil,' closely resembling the alban and fluavil found in gutta-percha. It contains no alkaloid.



FIG. 32 — *Calotropis gigantea*—Stem, Leaf, and Flower $\frac{1}{2}$.

Case — Cattle Poisoning by madár.—In 1896 a piece of cloth, stiffened with a sticky substance alleged to be *madar* juice and taken from the stomach of a cow, was sent for examination. An alcoholic extract of the rag was given to a cat, which died within half an hour. The symptoms noticed were:—Vomiting, profuse salivation, severe tetanic convulsions, extremely slow and stertorous breathing and dilation of the pupils.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

¹ Warden and Waddell in *Pharm. Journ.*, August 22, 1885

Identification.—The root bark (official I addn to B.P.) occurs in short, flat or arched pieces $\frac{1}{16}$ th to $\frac{1}{8}$ th of an inch thick. The outer surface is yellowish-grey, soft and corky, fissured lengthwise, and can be

Drury describes the flowers of *C. gigantea* as rose-colour and purple mixed, and those of *C. procera* as pale purple.



FIG 33 — *Calotropis gigantea*—Root $\frac{1}{2}$

Cryptostegia grandiflora, Syn. *Nerium grandiflorum* (see Fig. 34).—This is a climbing plant belonging to the N.O. *Asclepiadec.* The stalk yields a milky juice, which, when dried, solidifies into a substance resembling india rubber. One fatal case of poisoning by this plant has been reported as follows —

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Tylophora fasciculata, vern. *Bhui-dori* (see Fig. 33).—This plant is abundant in the Southern Konkan, where it is used as a rat poison. One homicidal case of poisoning by administration of the pounded roots in

food has been reported (see below). From the symptoms stated to have been present in this case, viz. tingling in the mouth, dryness of the throat, giddiness, loss of power over the extremities, and insensibility with dilated pupils, the poison appears to be narcotico-irritant in its action.

of the throat, great thirst, and a feeling of soreness over the whole body. Their pupils were dilated, and pulse full and slow. They stated



FIG. 34.—*Nerium grandiflorum* vel *Cryptostegia grandiflora*.

A small patch of redness on the mucous membrane of the stomach. Accused in this case, it was stated, was at enmity with the persons poisoned, and asked a friend to recommend him something to kill rats with. The friend advised him to use bhui-doree. On this accused, it

was reported, obtained some *bhui doree* roots, and having reduced them to powder mixed this with some flour, from which subsequently the food eaten at the meal referred to was prepared.



FIG. 35.—*Tylophora fasciculata*

Cases.—A young man, suffering from gonorrhoea, took the juice of this plant about 10 P.M., and died next morning with slight convulsions of upper extremities and unconsciousness. A man and his wife were given this plant by a native quack doctor also as a cure for gonorrhoea. At 7 P.M., three hours after, both complained of acrid feeling in mouth and throat followed by nausea, vomiting, purging, collapse and death next day. In both cases the alkaloid *tylophorine* was extracted from the viscera. The accused native doctor was sentenced to 18 months' rigorous imprisonment. His defence was that three days' doses had been taken all at once.—*Med. Chem. Ec. Rev.*, 1893.

Convolvulacæ.

• . .

considered by Flückiger and Hanbury to be identical with convolvulus. No case of poisoning by these seeds has been reported, but in large doses

the seeds in water the
which envelops the folds

are rather lighter in colour.

Cucurbitacæ.

Elaterium.—This is the sediment from the expressed juice of the *Ecbalium elaterium* (syn. *E. officinarum*), or squarling cucumber. It is a powerful cathartic, and is used in medicine as a purgative in doses of one-sixteenth to half a grain. One grain has caused severe symptoms and probably but little more would be required to cause death. The active principle is elaterin, a white crystalline substance obtainable by

green, and covered with numerous short fleshy prickles, terminating in white elongated points. When ripe it separates suddenly from the stalk, violently expelling the juice and seeds.

Cuscuta reflexa, Akaswili, Ghagurbei (see Fig. 36)—This is a parasitic plant with small flowers, common on bushes in

Citrullus colocynthis—*Indriyan* (Hind.), *Peyhomatti Tumat* (Tam.), *Kururindawan* (Mar.)—The colocynth of the pharmacopœias, used in the dried and

mentions a case where a teaspoonful and a half of the

¹ Pharmacographia, p. 262.

² Ind. Med. Gaz., January, 1885.

³ Mat. Med., p. 352.

⁴ Poisons, p. 595.



FIG. 36 — *Cuscuta reflexa*.

gative The wild variety, dried, is made into musical instruments, bottles, etc., and it is stated that some sailors were once poisoned by drinking beer which had been standing in a bottle made from one of these gourds.¹ *Citrullus amarus*.—This is the wild form of the *C. vulgaris*.

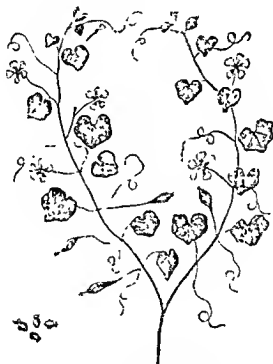


FIG. 37.—*Memordica cymbalaria*.

is said to possess properties similar to those of the official colocynth.

¹ Lindley, quoted by Birdwood.

² Murray's *Plants of Sind*, p. 11.



FIG. 38.—*Momordica charantia*.

its seeds." The roots are tuberos and ovoid. Three cases in the last few years have been reported to the Bombay Chem. Analyzer, in which it was stated that abortion had been caused by the administration of a decoction of these roots

Momordica charantia, *Karela* (Hind.), *Karla* (Bomb), *Pala kani* (Tam), (see Fig. 38).—The fruit of this is bitter, but wholesome. It is

¹ *Drugs of India*, p. 118.

² *Drug Disp.*, p. 251

caten, but requires to be steeped in salt water before being cooked. A case was reported to me in 1879, in which it was stated that swallowing a decoction of the roots of this plant caused abortion at the seventh month.¹

Luffa acutangula, var. *ai*
Kadu dorha (Bomb.), *Ghoska*.
describes the fruit as smooth,
with ten prominent sharp lon-



FIG. 39.—*Luffa echinata*

small operculum rather more than $\frac{1}{2}$ -inch in diameter, which is deciduous. The seeds are grey, and marked with small, irregular, black, prominent specks. Sakharan Arjun² describes the fruit as violently cathartic and emetic.

Modecca palmata.—In Madras a girl ate some of the fruit of this gourd, and was attacked by severe irritant symptoms and died a week after.³

Luffa echinata, *Kukar-wel*, *Diodangri* (see Fig. 39).—The fruit of this

¹ *Bo Chem Analyser's Rept.*, 1879-80.

² *Bo Drugs*, p. 59.

³ *Trans Bo Med. and Phys Soc.*, 1837.

Euphorbia.

The Euphorbias all yield an acrid milky juice possessing properties similar to those possessed by the juice of *E. resinifera*,



FIG. 40.—*Euphorbia rothiana*

and probably also possessing the same chemical composition.¹ Various writers mention the following Indian species as plants the juice of which is employed in native practice, externally as caustic or vesicant, or internally as a purge. Occasionally,

¹ *Mad Chem Ex. Rept*, 1893, and Dr Warden, *Pharm Jour*, 1890, p 937.

² Pluckiger has also found euphorbon in *E. Tirucalli* and *E. catimaudoo*.

eaten, but requires to be steeped in salt water before being cooked. A case was reported to me in 1879, in which it was stated that swallowing a decoction of the roots of this plant caused abortion at the seventh month.¹

Luffa acutangula, var. *amara*, *Karu-turai* (Hind), *Kadu sirola*, *Kadu dorka* (Bomb.), *Ghosha-lata* (Beng), *Sendubir-lai* (Tel.)—Dymock describes the fruit as smooth, 3 inches to 5 inches long, ovoid, marked with ten prominent sharp longitudinal ridges, and having at the apex a



FIG. 39.—*Luffa echinata*

small operculum rather more than $\frac{1}{2}$ -inch in diameter, which is deciduous. The seeds are grey, and marked with small, irregular, black, prominent specks. Sakharan Arjun² describes the fruit as violently cathartic and emetic.

Modecca palmata.—In Madras a girl ate some of the fruit of this gourd, and was attacked by severe irritant symptoms and died a week after.³

Luffa echinata, *Kuhar-wel*, *Deodangri* (see Fig. 39).—The fruit of this

¹ *Bo. Chem. Analyser's Rept.*, 1879-80

² *Bo. Drugs*, p. 59.

³ *Trans. Bo. Med. and Phys. Soc.*, 1887.

Euphorbia.

The Euphorbias all yield an acrid milky juice possessing properties similar to those possessed by the juice of *E. rostrata*,

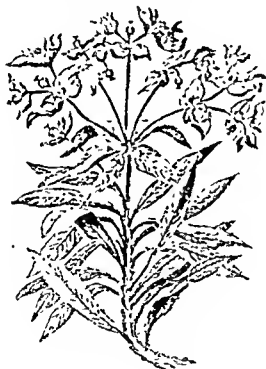


FIG. 40.—*Euphorbia rostrata*.

ical composition.¹
species as plants
practice, externally as
caustic or vesicant, or internally as a purge. Occasionally,

¹ *Med. Chem. Ex. Rept*, 1893, and Dr Warden, *Pharm Jour*, 1890, p 997.

² Flückiger has also found euphorbon in *E. Tirucallis* and *E. cattimaudo*.

also, the juice of one of the euphorbias, or a twig of one of them, is used as a local irritant application for the purpose of causing abortion; or homicide is attempted by mixing the juice with food

¹vern. *Farfiyun*, is the dried milky
ranches of *Euphorbia resinifera*,

It is used in Europe in veterinary practice as a vesicant. Applied to the skin it causes irritation and vesication, and when swallowed is an extremely active irritant poison. A teaspoonful given to an adult in mistake for rhubarb caused death in three days. Inhalation of the dust raised in grinding euphorbium is reported to have caused headache, giddiness and stupor.¹ Fluckiger found euphorbium to owe its acrid

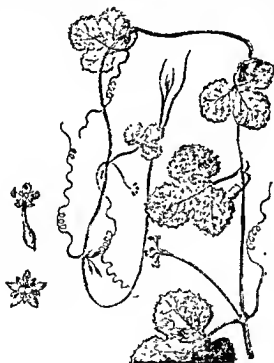


FIG. 41.—*Corollacarpus epigea*.

properties to an amorphous neutral resin readily soluble in cold spirits of wine. Of this 20

and strong nitric acid be slowly added by means of a glass rod, a fine

¹ Christison, *Poisons*, p. 582

Corollacarpus epigaea (syn *Bryonia epigaea*), *Palasgaddah*, *Alasgaddah* (Hind.), *Karur nai* (Bo.), *Alasha garudan* (Tam.) (see fig. 41).

The root of this plant contains a yellow bitter principle, which, Dymock suggests, may possibly prove to be identical with bryonin. The root is used, in doses of about one drachm in twenty four hours, as a purgative.

(C. L.) *Tiglitum*.—*Jamulgota* (Hind. and) *ervulam* (Tam.), *Naypalum* (Tel)—Both the seeds of this

plant, and the oil expressed therefrom—croton oil—are highly poisonous. The oil is used in medicine as a purgative in doses of one-third of a minim to one minim. Applied to the skin, it vesicates. The Linimentum crotonis B.P., used as a counter-irritant external application, consists of one volume of croton oil to seven volumes of a mixture of equal parts of cajuput oil and rectified spirit. Three drops of the oil proved fatal to a child one year old, and half a drachm has caused death in an adult. In one case an adult died in four hours from a dose of $2\frac{1}{2}$ drachms. One or two grains of the seeds, when swallowed, suffice to cause severe pain, with copious watery stools. A case also is reported in which severe symptoms (pain and collapse but no purging) appear to have been produced by inhaling the dust raised in emptying packages of the seeds.

The poisoned arrows of the Abor tribe of Assam were found to contain croton oil (Maj. Windsor, *I.M.G.* Jan. 1912), and derived from a paste of the pounded plant, and not the seeds.

¹ *Pharmacographia*, p. 504.

² *Useful Plants*, p. 204

³ *Mat Med*, p. 631.

⁴ *Bo Chem. Analyser's Rept*, 1874-75.

Kobert, from recent researches, attributes the activity of croton oil to croton oleic acid (distinct from crotonic acid) present in the oil, both free and as a glyceride. Besides this, croton oil also contains the glyceride of a peculiar acid—tiglic or tiglinic acid—isomeric with angelic acid $C_8H_8O_2$.

IDENTIFICATION.—The seeds are oval, more arched on the dorsal than on the ventral surface, about half an inch long by nearly two-fifths of an inch broad, and weigh about four grains each. The testa is black, thin, and brittle, and more or less covered by a thin cinnamon-brown coat. The kernel is white, is enclosed in a delicate white membrane, and easily splits into two halves, between which lie two foliaceous cotyledons, and a short thick radicle. The oil may be extracted from the seeds or other matters by exhaustion with ether, and recognized by its vesicating action on the skin. The seeds of the following are stated to resemble those of croton tiglium in appearance and properties. *Baliospermum montanum*, vern. *Danti*. These, Dymock states, are often sold as *Jamalgota* by druggists; and *Croton oblongifolium*, *Baragach* (Beng.), *Ganasur* (Bo.), *Gonsurong* (Goa).

In croton poisoning pain is felt at the back of the throat, which comes on some time after the poison has been swallowed; and it is immediately relieved by a dose of bismuth.

Case—Croton-oil poisoning, homicidal (attempt).—In a boarding-school at Patna in 1899 a boy servant was beaten by the cook and complained to his mother, who remonstrated with the cook; but obtaining no satisfaction she threatened to have her revenge. The cook, as usual, prepared the evening meal which was partaken of by four or five boys. A short time after they all exhibited symptoms of irritant poisoning, attended with frequent vomiting, looseness of bowels and pain in the abdomen. The medical man, who was called in, treated the cases as croton-oil poisoning. Some vomited matter and cooked food (rice and vegetable) were sent for examination, and croton-oil was detected in them. A quantity of curry powder was also forwarded, but it was found to contain no poison. The boys all recovered. It was suspected that the woman had mixed powdered croton-seeds with the cooked food in the kitchen during the cook's absence, croton-seeds being readily obtainable from any banyia's shop in the bazaar.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Castor-oil seeds and oil.—*Ricinus communis*.—*Arandi* (Hind.), *Erendi* (Bo.), *Bherenda* (Beng.), *Amanak-kani-chedi* *Sittamunah*, *Valluk* (Tam.), *Citavanahloo*, *Aranak*, *Pandiaranak* (Mal.), *Sittamindi*, *Amidum* (Tel.).—Castor-oil, if expressed from the peeled and winnowed seeds, without the aid of heat, is mildly purgative. The seeds, however, are highly poisonous. Three grains of the seeds have caused alarming symptoms, and a case is reported where three seeds proved fatal to an adult in

forty-six hours. Fatal cases of poisoning by castor-oil seeds administered in food have been reported. The poisonous principle of the seeds is an albumenoid body (*ricin*), a 'toxalbumen' resembling the active principle of *abrus* seeds (which see), which gives rise to violent inflammation of the alimentary canal, but not to catharsis, and ten seeds contain about one-tenth of a gram of ricin, or sufficient to cause death in an adult.¹ IDENTIFICATION.—Castor seeds resemble *croton tiglium* seeds in shape and internal structure, but are somewhat smaller. The testa also differs in colour, being grey marked with brown blotches. The oil is distinguished from other fixed oils by being soluble in glacial acetic acid and in alcohol. It is completely soluble in four volumes of spirits of wine at 15° C. There is



FIG. 42.—Physic nuts (*Jatropha multifida*).

also a large variety of castor seed, of a reddish colour with brown blotches, the oil obtained from which is much used for industrial purposes.

Physic Nuts.—*Jatropha curcas*.—*Jangli arendi* (Hind.), *Bāghheranda* (Beng.), *Moghli arendi* (Bo.), *Kattamanakku* (Tam.), *Galamark* (Goa).—The fruit of this and of the other *jatrophas* named below (physic nuts) contain oily poisonous seeds. The action of these seems to be similar to that of *croton tiglium*.

ing and purging have been caused by swallowing a few grains of the cake left after expression of the oil from the seeds. Several cases of accidental poisoning by physic nuts are recorded, and Chevers mentions one where in addition to the usual irritant symptoms, muscular twitchings, deafness, impairment of sight, and loss of memory were present. The fruits of *J. multifida* and of *J. glandulifera*, *Undarbibi*, *Jangli arendi*

¹ *Stallmark, Drop. Arb*, iii, 1889



FIG. 43 — *Jatropha* Leaves (1, *curcas*; 2, *glandulifera*; 3, *multifida*).

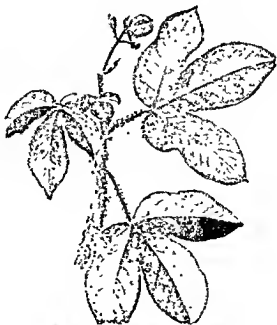


FIG. 44 — *Jatropha glandulifera*.

(Ba.) *Lallherenda* (Beng.), *Adilaleq* (Tam.), *Nela-amuda* (Tel.), are quite as poisonous as those of *J. curcas*. IDENTIFICATION.—The fruits of all are three-celled and three-seeded. *J. multifida* has fruit as large as a walnut of the shape shown in Fig 42. Those of *J. curcas* are of about the same size, but more uniformly oval in shape, and those of *J. glandulifera* are not bigger than a hazel-nut, oval, and marked externally with six deep longitudinal grooves. The three plants also may be distinguished by the shape of their leaves (see Fig 43). The seeds of all three varieties in shape and internal structure closely resemble castor-oil seeds. *J. curcas* seeds are about three-quarters of an

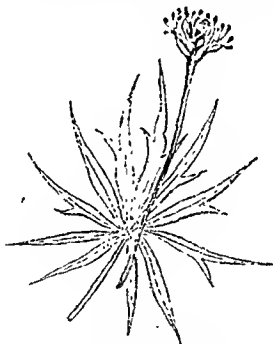


FIG. 45.—*Jatropha multifida*.

inch long and rather less than half an inch broad. *J. multifida* seeds are somewhat broader, and *J. glandulifera* seeds are only three-tenths of an inch long and two-tenths of an inch broad. *J. curcas* and *J. multifida* seeds are black with a white scar at one end, while *J. glandulifera* seeds are grey with two brown stripes on the dorsum.

Other Euphorbiaceae.—The following other plants of this order are of medico-legal interest:—

Manihot utilissima (*Jatropha manihot*), the Cassava.—This plant is cultivated in Southern India for food, the boiled root being a staple of diet. It is a native of the West Indies, where its starchy root is used as an article of food under the name of *cassava*. From the root also is prepared the 'tapioca' of commerce, after dissipating the poison by roasting. Two varieties of it exist—a sweet and a bitter variety. The latter abounds in a poisonous milky juice containing *hydrocyanic* acid, to which its toxic power is due. Owing to its volatility, however, this is entirely removed by heat, and hence bitter cassava root may be utilized as an article of food, after the juice has been squeezed out and the root has been cooked. Two fatal cases of poisoning by this root were reported from Madras in 1898, one a child, and another several families.¹

Jatropha urens.—This al covered with stinging hairs, instances caused serious sy extremes collapse came on in swelling in the part touched lasted for some days. *Manihot* nella, *Manihot*.—This tree, also a native of the West Indies, yields an acrid milky juice, which, applied to the skin, causes violent inflammation, *Chenopodium*

Gribble² mentions that it has recently been identified as the poison in some cases of irritant poisoning occurring in the Madras Presidency.

Karlajuri or Pasu.—*Cleistanthus collinus* (Benth.), *Cluytia collina* (Roxb), *Lebideiopsis orbicularis*. Vern 'New larg.' The bark of this tree, which grows in Chota Nagpur, is used by the Kols for poisoning *Chenopodium*.

by Roxburgh to be poisonous.

¹ *Med. Chem. Ex. Rept.*, 1898.

² *Med. Jur*, p. 275.

³ Taylor, *Poisons*, p. 501.

⁴ *Poisons*, p. 592.

⁵ *Med. Jur*, p. 255.

widely dilated pupils, extreme prostration, and death in five hours. The ethereal extract of the bark was not poisonous. A portion of the plant was sent to the Botanic Gardens and identified as an *Euphorbiaceous* species named *Cleistanthus collinus* (Benth in *Flora of British India*).—*L. A. Waddell Beng Chem Tr Rept.* 1897

Liliaceæ

Aloes.—*Ela* (Hind. and Beng.), *Ela*, *Pitalabola*, *Kalabola* (Bo), *Kariya-pilam* (Tam.)—This well-known medicinal substance is the inspissated juice of the leaves of the *Aloe vulgaris* and other species of aloes. It is a powerful drastic purgative, acting specially on the rectum. The usual medicinal dose is three to five grains. In large doses aloes is an irritant poison; two drachms has caused death, and a case was recently reported to the Bombay Chemical Analyser's Office in which a man appears to have died from the effects of swallowing, as a purgative, a decoction of wild aloes leaves. Aloes has a stimulant action on the uterus, and in Europe is frequently given or taken for the purpose of procuring abortion. A form in which it has often been used for this purpose is *hiera picra* or boly bitter, a mixture of four parts aloes to one of canella bark. Aloes also is an ingredient of Morrison's and most quack purgative pills. The active principle of Barbadoes aloes is barbaloin, a glucoside. Other varieties contain natalion and socalion, bodies probably members, with barboloin, of a homologous series.

Squill.—Official squill is the sliced and dried bulb of *Urginea Scilla* (syn *Scilla maritima*). In doses of six to fifteen grains it acts as an emetic, and in larger doses as an irritant poison, causing vomiting, purging, griping pain, strangury, and bloody urine. In poisonous doses squill causes marked depression of the heart's action. Convulsions also have been observed in poisoning by this drug¹. Twenty-four grains of the powder has caused death. The active principle is scillitin, apparently a glucoside.

Gloriosa superba.—*Languli*, *Karihari*, *Kulhari* (Hind.), *Bishai-languli* (Beng.), *Indai*, *Nagharua* (Bo), *Kalaiippakkizhaugu* (Tam.).—The tuberous root of this plant is popularly believed in India to be highly

¹ Christison, *Poisons*, p. 214.

² But Mr. Hunter, Chem. Exmr, Rangoon, has only had about six such cases referred in eleven years.

³ Dymock's *Mat. Med.*, p. 833.

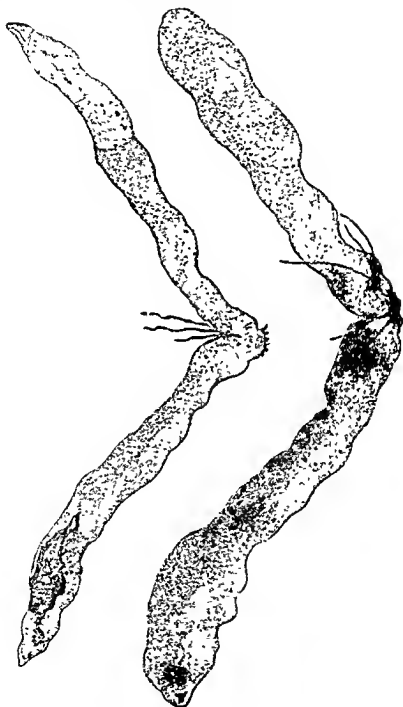


FIG. 46—*Gloriosa superba* Root. (Natural size.)

root (see Fig. 46) as "tubercous, cylindrical, and flattened, often seven to eight inches long and about one inch in diameter, it consists of two tubers which unite at a right angle, one being much smaller than the other, at the point of union may be seen on the upper surface a circular scar marking the attachment of the stem, and on the under surface, immediately beneath it, another, to which a tuft of thin rootlets is often attached. The tubers are covered with a brown epidermis, except at the point which is tapering and nearly white, like the growing part of a young kidney potato. Internally they are juicy, white, and farinaceous, and have a faint acrid odour, the taste is mucilaginous, feebly bitter, and a little acrid." *Gloriosa superba* root is said to be used in India as an adulterant of aconite root.

Case—Poisoning by *gloriosa superba*.—Dr. Battacharjee, *Ind. Med.*

covering of the fundus of the uterus (unimpregnated) was also found inflamed.

Ranunculacæ

The Hellebores.¹—These, natives of Europe, are all highly poisonous. The principal species are *H. niger*, or Christmas rose, the *melampodium* of the old Pharmacopœias; *H. fetidus*, bears'-foot, fetter-wort, or felon-grass, and *H. viride*.² They are compound irritants, causing violent vomiting and purging (the latter, however, has in some cases been absent), and great collapse. Convulsions and insensibility have also been observed. Two poisonous glucosides have been obtained from the hellebores, namely, helleborin and helleborein. These, especially the latter, are powerful heart poisons. Black hellebore root, in doses of a few grains, acts as a drastic purgative, and thirty grains of an aqueous extract of the root has proved fatal to an adult. The leaves of the hellebores are also poisonous, and a case is reported where a child, *æt* 2, was killed by two dessertspoonfuls of an aqueous infusion of the leaves of *H. viride*, given as a vermifuge.

Anemone pulsatilla and other species of *anemone*, and *Ranunculus acris* or 'buttercup,' *R. sceleratus*, and other species of *ranunculus*, contain an acrid oily matter, acting as a vesicant when applied to the skin, and when swallowed as a compound irritant poison, causing, in addition to

¹ The name "hellebore" is also applied to certain species of *veratrum* plants belonging to the N O. *Melanthaceæ*.

² Murray's *Plants of Sind*, p. 73.

Actaea racemosa (syn. *Cimicifuga racemosa*), Black snakeroot or black Cohosh.—The rhizome and rootlets of this plant are officinal in the United States Pharmacopœia. In large doses it causes nausea and vomiting, and depresses the system. It is reported to have folk by some as species of plant belonging to it as a cardiac depressant readily produced by.

To this order also belong *Aconitum napellus* and *A. ferox*, which are cerebro-spinal and cardiac poisons.

Thymelacæa

Mezereon.—*Daphne mezereon*, and *D. laureola* [or Spurge-Laurel] and other species of the same genus, are compound irritant poisons.

of the plant caused irritant symptoms, followed by abortion and uterine

Aroidæ.

The tuberous roots of many of the *arums*, a genus of this order, when taken into the mouth, cause immediate burning pain, great swelling of the tongue, and salivation, and when swallowed give rise to symptoms of irritant poisoning. The roots of many contain much starch, and are used, after washing and baking, as articles of food. The following may be specially mentioned.—

Arum maculatum, 'lords and ladies,' cuckoo-pint.—This, common in England, has given rise to several cases of accidental poisoning, chiefly

¹ On 'Poisons used in the Panjab,' quoted by Chevers, p. 285

² *Bo. Analyser's Rept.*, 1874-75, p. 10.

among children, from eating the leaves. In some of the cases convulsions and dilated pupils are reported to have been present. The tuberous root—poisonous when fresh—after sleeping in water and baking, is used as an article of food under the name of Portland Sago—*Arum megianum*—*dumb cane*.—A native of the West Indies. Two drachms of the juice of this plant has been known to prove fatal in a few hours. *Arum montanum*, *Konda-rakis* (Tel.), and *Arum lyratum*, *Adani*.—These are both, Drury states, natives of the mountainous parts of the Northern Circars. The root of the first is so poisonous that it is used to poison tigers, the root of the second is used as an article of

an article of diet in India when roasted or boiled. Two cases of poisoning by the tubers of this plant, both non-fatal, were reported in Bengal, in 1886 (see below)

Case.—*Arum*—*Kachu* poisoning.—In a case from Dibrugarh in Assam, a sick coolie had some fried *Kachu* administered to him and experiencing a burning sensation spat it out, whereon a pig ate what had been ejected and died in an hour, and a second pig was given some and also died. Dr Warden failed to extract from the tubers any active principle, but found them to contain bundles of needle shaped crystals of oxalate of lime, which would, he thought, mechanically account for the irritant symptoms, but boiling destroys the poison of most *Arums* and has no effect on the oxalate of lime.

Amaryllidaceæ

Daffodil—*Narcissus pseudo-narcissus*.—This, common in England, is mentioned by Guy and others as an irritant poison. Other species of *narcissus* also have a similar action. The root of an Indian plant of this order, namely, *Crinum asiaticum*, vern *toricarum*, is officinal in the Pharmacopœia of India as an emetic, and Dymock mentions that the bulb of *Crinum ornatum*, *Gadambikanda* (Bo.), is extremely acrid, and it is used for blistering cattle, a shoe being bound on the skin.

Other Orders.

The oil, shaken with an equal volume of strong nitric acid, acquires a deep crimson colour, the acid at the same time becoming similarly coloured. The crushed seeds, warmed with strong nitric acid, give a

the usual symptoms of irritant poisoning, depression of the heart's action, slow respiration, paralysis, and convulsions. The acrid oily matter may be separated from the plants by distillation with water; and the plants,

grows in Sind and the Panjab, and is virulently poisonous.

Actaea racemosa (syn *Cimicifuga racemosa*), Black snakeroot or black Cohosh.—The rhizome and rootlets of this plant are official in the United States Pharmacopœia. In large doses it causes nausea and vomit-

and *Aconitum napellus* and *A. ferox*, which are cerebro-spinal and cardiac poisons.

Thymelacæe

Mezereon—*Daphne mezereon*, and *D. laurcola* [or Spurge-Laurel] and other species of the same genus, are compound irritant poisons.

and which is composed of long white fibres easily separable from

Aroideæ.

The tuberous roots of many of the *arums*, a genus of this order, when taken into the mouth, cause immediate burning pain, great swelling of the tongue, and salivation, and when swallowed give rise to symptoms of irritant poisoning. The roots of many contain much starch, and are used, after washing and baking, as articles of food. The following may be specially mentioned.—

Arum maculatum, 'lords and ladies,' cuckoo-pint.—This, common in England, has given rise to several cases of accidental poisoning, chiefly

¹ On 'Poisons used in the Panjab,' quoted by Chevers, p. 285

² *Bo Analyst's Rept.*, 1871-75, p. 10.

purging, etc., with extreme giddiness, faintness, dimness of vision, followed by delirium and epileptiform convulsions, stupor, and loss of voluntary power.

A few cases of poisoning by *cocculus indicus* berries have occurred in Europe and America. In one case a child died from the application of an alcoholic tincture of the berries to the head. A decoction or extract of *cocculus indicus* has been used in England as an adulterant of beer, porter, etc., in order to increase its intoxicating power, and it is said to be largely used for the same purpose by the liquor retailers of Bombay. In England *cocculus indicus* has been used by thieves to stupefy their victims in order to facilitate the commission of theft, and in 1881 a case was referred to the Bombay Analyser, in which it was alleged that it had been used for a similar purpose. The Bombay records also show that during the last ten years *cocculus indicus* was detected in three cases of alleged cattle poisoning. In India *cocculus indicus* berries

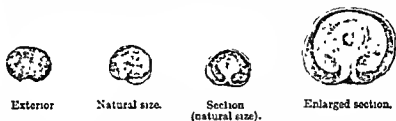


FIG. 47.—*Cocculus indicus*.

are used as in England as a fish poison. In medicine *cocculus indicus* is only used as an external application as a parasiticide (see also 'Spinal poisons'). FATAL PERIOD.—Of six persons accidentally poisoned by decoction of the berries, two died within half an hour, the remaining four recovering after several hours.¹ IDENTIFICATION.—The dry berries are nearly globular, about half an inch or rather less in diameter, and have a blackish wrinkled surface. On section they are seen to contain a peculiar mushroom-shaped body, consisting of a cup-shaped seed, supported on a stalk formed by a projection inwards of the endocarp (see Fig. 47). The pericarp is tasteless, the seed is bitter. From organic mixtures picrotoxin may be separated by digesting the matter under examination with alcohol, evaporating the alcoholic tincture nearly to dryness, and treating the extract so obtained with acidulated water. The acid watery solution is then to be filtered, shaken with ether, and the latter separated

¹ Wharton and Stille, *Med. Jur.*, 499.

and evaporated to dryness, when picrotoxin, if present, will be found in the residue. Picrotoxin is not precipitated from solution by the group tests for the alkaloids. It has a bitter taste, reduces alkaline copper solutions like grape sugar, and dissolves in strong sulphuric acid, forming a yellow solution, which on addition of a trace of potassium dichromate becomes violet, changing into brown.

Ergot.—This is the sclerotium (compact mycelium) of *Claviceps purpurea*, a fungus parasitica within the palea of numerous plants of the order Gramineæ. Rye so affected constitutes the ergot of rye used in medicine. Other cereals, e.g. wheat and oats, are liable to the affection.¹ In large single doses ergot causes the usual symptoms of irritant poisoning, accompanied by headache, giddiness and stupor, depressed action of the heart, and dilated pupils. Acute poisoning by ergot is very rarely met with. Outbreaks of ergotism, or chronic poisoning by ergot, arising from the use of affected grain as food, have occurred in France and Germany. Ergotism shows itself in two forms—a convulsive and gangrenous form. Both commence with gastrointestinal disturbance. In the first, giddiness, aberrations of vision, loss of sensation in the hands and feet, spasms and convulsions, are the prominent symptoms. In the second, dry gangrene of the extremities is the principal effect.

Ergot causes contraction of the uterus, and hence is used in the early stages of pregnancy to arrest haemorrhages and to induce contractions of the uterus. Thus Taylor mentions a case where a woman took about a teaspoonful of tincture of ergot three times a day for eleven weeks, and died at about the third month of pregnancy without having aborted.² The medicinal dose of powdered ergot in uterine diseases is

consists of fusiform grains one-quarter of an inch to one and a half inch

in length and about one sixth to one third of an inch thick. Externally the grains are deep purple, internally they are white or pink. They have a peculiar fishy odour, which becomes more developed on the addition of potash. Ergots of other grains chiefly differ from ergot of rye in length and thickness.

Gamboge, *Ussarah-i-Reuand*, *Gutaganba* (Pers., Hind., and Bo.), *Mulki* (Tam.).—This is a gum resin from *Garcinia morilla*, N. O. *Guttifera*, and is used in medicine in doses of one to five grains as a drastic purgative. One drachm has caused death. A case, however, occurred in Bombay in which a girl, *et al*, intending to commit suicide, swallowed three drachms, but recovered under treatment. **IDENTIFICATION**.—A tawny or brownish orange substance, generally met with in cylinders one to two and a half inches in diameter, with an acrid taste, forming a yellow emulsion with water, and violently purgative.

Moringa pterygosperma, the Horse-radish tree, N. O. *Moringaceæ*, *Sahyna* (Hind.), *Shagra*, *Shogat* (Bo.), *Murungai* (Tam.).—The fruit of this tree is eaten as a vegetable, and the root is used as a substitute for horse radish, which it exactly resembles in taste. K. Lal Doy¹ states that one of the methods of procuring abortion in use near Calcutta, is the administration of a dose consisting of about half an ounce of pounded *sahyna* bark mixed with twenty-one black pepper-corns, and that this is a very dangerous means, the mother as a rule dying when it is resorted to.

Lal-Chitra.—*Plumbago ceylanica*.—*Chitrak* (Hind.), *Chitta* (Beng.), *Chitra* (Bo.), *Chittira* or *Chittira Mulam* (Tam.); and *Plumbago rosea* (syn. *P. coccinea*), *Lal-chitra*, *chita*, or *chitra* (Hind., etc.), *Shirappu chittira* (Tam.), N. O. *Plumbaginaceæ* (see Fig. 48).—The roots, and probably other portions of these plants, contain a highly acrid crystallizable non-alkaloidal principle called *plumbagin*. The bruised roots applied to the skin cause vesication. Taken internally, in large doses, *plumbago* root acts as an irritant or narcotico-irritant poison.

Plumbago root in India is sometimes administered internally as a poison, and Chevers² refers to two fatal cases, one of them a case of homicide, in which it was so employed. More commonly in India *plumbago* root is used for the purpose of causing abortion. With this object it is sometimes given internally, and has been more than once detected as *plumbagin* in pills stated to have been administered for this purpose. Usually, however, it is employed as a local irritant application to the *os uteri*, a portion of the root or a twig of the plant being pushed into the vagina, and sometimes even into the uterus. In other cases the cotton-covered end of an abortion-stick (p. 314) is smeared

¹ Chevers, *Med. Jur.*, p. 716

² *Med. Jur.*, p. 252

with a paste made from the powdered roots; and I once met with a case in which a lump of such paste was simply thrust into the upper part of the vagina, and was found there after death. It is also used as an irritant to skin by malingerers or to support false charges, see *Case* below.

DETECTION.—The roots are $\frac{1}{4}$ to $\frac{1}{2}$ an inch in diameter, dark brown externally, and reddish within; from them and matters



FIG. 48.—*Plumbago zeylanica*.

containing it, plumbagin may be extracted by digesting the
off

with ether. The ether is then separated, evaporated to dryness, and the residue tested for plumbagin. Plumbagin treated with caustic potash solution dissolves, forming a bright crimson liquid. Hydrochloric acid added to this changes the colour to yellow, and on standing the liquid deposits yellow flocculi of plumbagin, which may be separated by shaking the acidified fluid with ether. An alcoholic solution of plumbagin gives a crimson precipitate with solution of basic acetate of lead.¹

bringing a false charge, and sentenced to four years' imprisonment.—*Ind. Med. Gaz.*, 1900, p. 8

It

* *O Apocynaceæ*;
chapo (Guz) (see
is blunt truncate

branches and white and yellow flowers. It abounds in viscid juice, which dries into a substance resembling india-rubber. "The root is a violent cathartic, and the blunt-ended branches are used to procure abortion."² The plant does not give any blue or green reaction with hydrochloric acid, like *Cerbera thevetia* and *O. odallum*. It contains plumeric acid in combination with calcium.³

Randia dumetorum, N. O. *Rubiaceæ*, *Mamphal* (Hind.), *Gelaphal* (Bo), *Maruk-kailan-lay* (Tam), *Menphal* (Beng.), *Mindhal* (Guz) (see Fig 50)—Dr George Bidie⁴ states that the fruit of this is apparently an irritant emetic, and is used to produce emesis by the poorer classes in Mysore, the dose being one ripe fruit well bruised. According to Ainslie, an infusion of the root bark also acts as an emetic, and Dymock mentions that the bruised nut is used in the Concan to preserve grain from the attacks of insects, and as a fish poison; Chevers,⁵ on the authority of Edgeworth, states that the fruit is used in the neighbourhood of Jalandhar, as an ingredient in medicines given by the mouth for the purpose of procuring abortion.

¹ S. Arjun, *Bom. Drugs*, p. 210

² Watts, *Dict.*, VIII., p. 1656

³ *Med. Jur.*, p. 720

⁴ *Pharm. of India*, p. 118.

IDENTIFICATION.—Dymock¹ gives the following description of the dried fruit:—"About the size of a crab apple, globular or oval, reddish brown, crowned with the rim of the calyx. It consists of a pericarp and shell, which contains the seeds embedded in pulp. The shell is hard and thick, two-celled, the dividing septum being thin and membranous. The pulp is

FIG. 49.—*Plumeria acutifolia*.FIG. 50.—*Randia dumetorum*.

grey, and has a nauseous taste and smell. The seeds are small and oblong, about $\frac{1}{8}$ th of an inch in length, slightly flattened, very hard, and of a brown colour. The average weight of the fruit is about sixty grains." In the dried fruit the seeds are found agglutinated together into two rough masses, each

¹ *Mat. Medica*, p. 408.

something of the shape of a coffee bean, but larger, one mass in each cell of the fruit.

Rue, *Ruta graveolens*, N. O. *Rutaceæ*, yields by distillation a pale yellow volatile oil of a strong disagreeable odour and acrid bitter taste. The oil—official B.P. and L.P.—appears to be the active principle of

In large doses, rue acts as an irritant poison, causing vomiting and prostration, with a feeble slow pulse and coldness of the extremities. Swelling of the tongue and salivation have also been observed. In Europe, rue has been frequently given or taken, it is said with success, as an abortifacient. *Ruta angustifolia*, *Sudab* (Hind), *Sulap* (Bo), *Arvada* (Tam.), is cultivated in most parts of India, and is used in native medicine in the same way that *R. graveolens*—for which it appears to be a perfect substitute—is used in Europe.

Savin.—The leaves and tops, and the berries of *Juniperus sabina*, N. O. *Coniferae*, contain an acrid volatile oil—oil of Savin—which, when applied to the skin, acts as a vesicant, and when swallowed, as an irritant poison. In addition to its irritant action on the alimentary canal, savin causes congestion of the kidneys and uterus. Owing to its action on the kidneys, strangury, hæmaturia, and even suppression of urine, may be present in cases of poisoning by it. Savin is used in medicine as an emmenagogue in doses of five to fifteen grains of the powdered tops, or one to fifteen minims of the oil. In England, savin is popularly believed to be an effectual abortifacient, and cases of poisoning by it are generally due to its having been given with this object. Savin often fails to cause abortion; sometimes it succeeds, generally, however, at great risk to life. Several cases are recorded where its administration caused abortion, followed by the death of the woman. IDENTIFICATION.—There is no reliable chemical test for the oil. If the leaves or tops have been given, fragments of these may be found and identified by comparison with a known specimen. The woody fibres, like those of other coniferae, exhibit circular discs. The leaves are minute and have a sharply acuminate point, while those of yew, another poisonous plant of the same order, have a lancet shaped apex. Savin leaves differ also from yew leaves in giving off when rubbed a strong peculiar odour.

Soap-nuts, *Ritha* (Hind and Bo), *Ponnau-kottai* (Tam), *Ringin* (Mar), the fruit of *Sapindus trifoliatus* (syn *S. emarginatus*), N. O. *Sapindaceæ*.—These are scarcely to be considered 'poison'. According to Dymock, the pulp, in four grain doses, is given internally as an anthelmintic and tonic, and a native authority recommends its administration in seventy-grain doses, with about eight grains of scammony, as a purgative. Soap-nuts contain the glucoside saponin, a white amorphous powder, soluble in water, and forming a solution which froths like a solution of soap. Saponin is an undoubted poison. Blyth states that one and a half to three grains of saponin administered by the mouth produces slight symptoms in the human system. Administered subcutaneously to the lower extremities, locally applied acts as an irritant, causes hæmorrhage, anaesthesia, absorbed into the system, it acts on the liver and the heart. Hence, as stated

by Blyth, in poisoning by saponin the symptoms would probably be great muscular prostration, weakness of the heart's action, and diarrhœa, and after death *post mortem* appearances of irritant poisoning would probably be found. Saponin is present in many other plants, e.g. in senega, in sarsaparilla; in the bark of *Quillaja saponaria* (soap bark), and in *Agrostemma githago* or 'common corn-cockle.' Blyth suggests that accidental mixture of corn-cockle seeds with wheat may possibly account for some of the mysterious cases of poisoning which have

and showing a heart-shaped scar on one side; each berry contains a single dark red-brown seed of similar shape to the fruit. The fruit-pulp

to this, the saponin precipitates. Saponin is insoluble in cold alcohol and in ether, strikes a red colour with sulphuric acid, and dissolves in water, forming a soap like solution.¹

Myrabalans, *Terminalia bellerica*, N. O. *Combretaceæ*; *Bhairah*, *Bahera* (Hind and Beng), *Bhada*, *Hela* (Bo.), *Taurik-hay* (Tam) — Two cases of accidental poisoning by the fruit of this tree have been reported. In one² three boys were poisoned; all however, recovered. In the other, of eight or nine recovering by narcotism

but it is not known to what they are due. IDENTIFICATION.—The tree's drupe is obovate, somewhat five angled, about the size of a nutmeg, fleshy, and covered with a grey silky down. When dry it is of the size of a gall-nut, and of a dirty brown colour and astringent taste. It contains abundance of tannin. The stone is hard, and encloses a sweet oily kernel.

Jequirity or Indian Liquorice.

Abrus precatorius, N. O. *Leguminosæ*; vernacular, *Rati*, *Gunj*, *Gungchi* (Hind.), *Gunza* (Bo.), *Gudumani* (Tam), *Charoti* (Guz.).—The seeds, roots, leaves, and other parts of this plant are irritant when applied to mucous membranes, and may be swallowed in considerable quantity without producing any ill effect, but if a small quantity of the seeds or of other portions of the plants be bruised and their juice injected under the skin of an animal, it rapidly proves fatal, producing general depression, drowsiness, fall of temperature, and hæmorrhagic lesions somewhat as in poisoning by snake venom. It is largely used in India for the criminal poisoning of cattle

¹ Blyth, *Poisons*, p. 439.

² Chevers, *Med. Jur.*, p. 273.

³ *Bo. Chem. Analyser's Rept.*, 1878-79, p. 14.

and occasionally for homicidal purposes (see *Case*, p. 379). For poisoning cattle it is used by the low caste leather-workers (*chamars*) in order to procure hides cheap. They pound the decorticated seeds into a paste with water and make the mass into small sharp-pointed spikes or 'needles' (*sui* or *sutari*), which they barden in the sun. When used, two of the *suis*, which are about three-quarters of an inch in length, are inserted into holes in a wooden handle by their base. A blow is then struck with great force, driving the *sui* protruding from the handle into the animal's flesh, where it is left, and causes death within 18 to 24 hours.

Action.—The irritant and poisonous action of Jequirity seeds was ascribed by Cornil and other continental pathologists to a bacillus. Dr L. A. Waddell disproved this theory, by an elaborate research¹ supervised by Professor Robert Koch, and in conjunction with Dr. Warden showed that the active principle was a chemical substance of a proteid nature which they isolated and called *abrin*. *Abrin* is a tox-albumen bearing much resemblance to snake-venom; and animals may become immune against it by repeated doses, and, like snake-venom, it has been resolved into globulin and other forms of albumin.² It acts as a blood-poison, imparting to the red blood corpuscles a tendency to coagulate and form thrombi. Of the seed, half a grain subcutaneously injected is sufficient to kill cats in twenty to forty hours, and one and a half to two grains is sufficient to kill cattle within forty-eight hours. In animals killed by abrus poisoning, oedema of the subcutaneous tissue is found at the seat of the injury if the animal has lived over twenty-four to thirty hours. The mucous membrane of the stomach and intestine is found highly injected, and numerous hæmorrhagic points are seen on the surface of the mucous membrane of the intestine, and also in the interior of vascular organs, *e.g.* the lungs, liver and spleen.³

Identification.—The seeds are spherical, about the size of a pea, polished, and of a bright scarlet colour, with a large black spot at one end, other varieties are white or blackish; their microscopical structure is peculiar.⁴ Their average weight is about one and three-quarters to a little over two grains. The root of this plant is officinal in the Pharmacopœia of India as a substitute for liquorice, and the seeds are used as small weights by jewellers, a '*rafi*' being the weight of one seed.

¹ *The Non-bacillar Nature of Abrus-Poison*, Beng Secretariat Press Calcutta, 1881

² *Ibid.*

³ L. A. Waddell, *op cit.*

⁴ By Dr Norris Wolfenden and others, *Proc Roy Soc*, 1889

For identification of the suis small slices or scrapings are made with a sharp knife, placed with a drop of water on a slide, and examined with a microscope. The characteristic thick walled cells from the *Abrus* seeds are readily recognized.¹ A drop of a dilute extract of a sui if placed in the eye of a frog causes, within 24 hours, an intense inflammation.

as follows:—"I used to earn my living at Sunt Aman Khan's. His *chela* turned me out and would not give me sufficient food. I stole

Murra then told me to go to Dooly Chamār, who was a great poisoner,

and black pigeons and a black kid. I gave him one rupee and a half, the price of the things. The next morning he came to me for five rupees. I did not pay it by

on the third day—"The brain and its membranes and the lungs, spleen, and kidneys were congested. The coats of the stomach were congested, and some ecchymosed spots were visible on its internal surface"—Dr Warden in *Pharmacograph. Indica*, I., 446.

Case.—In 1873 a man near Rawalpindi when sleeping was awakened in the morning by two blows on the neck, and appears to have seen his assailant retreating. After he went to work, his mother found two substances, each a little larger than a barley-corn, on his bed. At midday he complained of pain in the neck, and his mother found two

¹ Described by Dr. D Cunningham, *Ind. Med. Gaz.*, 1882, and reproduced in *Pharmacograph, Indica*, I., 432

cutting into the swelling much blood was found, and inflammation products which had extended to the right lung, which also was much inflamed

puncture was found.—Dr. Center, *Panyab Chem. Ex. Rept.*, 1873.

male, aged 30 years, from "needle" or "sut" poisoning. On *post mortem* examination there was a sloughing wound on the right side of the neck,

were found to consist of pounded "rat" seeds (*Abrus precatorius*)
Maj Black, *Panyab Chem. Ex. Rept.*, 1916

CHAPTER XXVII.

ANIMAL IRRITANT POISONS.

THESE may be divided into (1) poisons secreted by living animals, (2) poisons generated by dead animal tissue, including food-poisoning

POISONS SECRETED BY LIVING ANIMALS.

SNAKE VENOMS.

Death from snake-bite is usually *accidental*. From 15,000 to 20,000¹ deaths are annually reported in India as being due to 'Snake-bite,' but there is no doubt that this alleged cause of death conceals some undiscovered crime. Cases of undoubted murder by hanging, strangulation, abortion, etc., have been found to be conveniently reported as 'Death by snake-bite.' It is desirable, therefore, that the bodies of persons alleged to have died from snake-bite should be sent by magistrates, whenever possible, for examination by the civil surgeon or other medical officer.²

In 1900 the reported mortality from snake-bite in India was no less than 22,393 deaths, namely, in Madras Presidency, 2037; in Bengal, 10,557, in Bombay, 701, in N.-W. P. & Oudh, 8,056; in Panjab, 693; in Burma, 874, in Central Provinces, 994; in Assam, 170; in Coorg, 1; in Berars, 104; in Ajmere-Merwara, 4; in Bangalore, 2.

Homicide by snake-bite has not been reported of late years; but cases of cattle thus poisoned are reported (see p. 582); and many of the native quack-doctors keep dried cobra-venom as a remedy.³ So that it may occasionally be used for

¹ This death-rate is over 100 per million, ranging from about 45 per million in the Panjab to about 130 per million in Bengal. In one district of Bengal, namely, Burdwan, the snake-bite death-rate was 173 per million as the average of the 10 years ending 1899.

homicidal purposes though undiscovered. The crime of using snakes for murder is mentioned in Hindu and Mohammedan law; and formerly criminals in India were sometimes executed by snake-bite.

In Hindu law it was enacted that "if a man by violence throws into another person's house a snake or any other animal of that kind, whose bite or sting is mortal, this is *Shahesh*, i. e. violence. The magistrate shall fine him 500 puns of cowries and make him throw away the snake with his own hand." Halhed's *Code of Gentoo Law*, pp. 262, 263. Mohammedan law strangely provided that "if a person bring another into his house, and put a wild beast into the room with him, and shut the door upon them, and the beast kill the man, neither *lias* nor *diyat* is incurred; and it is the same if a snake or scorpion be put into the house with a man, or if they were there before and sting him to death. But if the sufferer be a child, the price of blood is payable" (quoted by Cheveis, *M*, 381). An execution by snake-bite is thus described by Terry of Sir Thomas Roe's suite "There was another condemned to die by the Mogul himself (while we were at Amadavar) for killing his own mother, and at this the king was much troubled to think of a death suitable for so horrid a crime; but upon a little pause he adjudged him to be stung to death by snakes, which was accordingly done. There were some mountebanks there which keep great snakes to show tricks with them, one of these fellows was presently called to bring his snakes to do that execution, who came to the place where that wretched creature was appointed to die, and found him there all naked (except a little covering before) and trembling. Then suddenly the mountebank (having first angered and provoked the venomous creatures) put one of them to his thigh, which presently entwined itself about that part, till it came to his groin, and there it bit him till the blood followed, the other was fastened to the outside of his other thigh twining about it, and there bit him likewise. Notwithstanding the wretch kept on his feet for near a quarter of an hour, before which time the snakes were taken from him; but he complained exceedingly of a fire that with much torment had possessed all his limbs, and his whole body began to swell exceedingly. . . . About half an hour after they were taken from him, the soul of that unnatural monster left his growing carcase."

There are also the classic instances of the employment of snakes in war by Hannibal and Antiochus defeating the Romans in a naval action by throwing earthen pots filled with serpents

dried cobra venom weighing over 100 grains—L. A. Waddell, *Deng Chem. Ex. Rpt*, 1884.

into their ships, and similar episodes are related of the Saracens; and in respect to *suicidal* use there is the story of Cleopatra and others.

Case.—Homicide by snake-bite.—In this case, two snake charmers were convicted at Purneah, Bengal, in 1869, of causing the death by snake-bite of three men. The prisoners, it was proved, partly by threats, and partly by assurances that it was in their power to prevent ill effects following, induced four men to allow themselves to be bitten by a krait. All four were poisoned, one only recovering. What the motive for the crime was did not appear—Fayrer's *Thanatophidia of India*, p. 51.

The popular division of snakes into poisonous (or venomous) and non-poisonous, although not strictly correct scientifically, may be adopted here for toxicological purposes. Poisonous snakes, of which many species are known within Indian limits, belong to one or other of two families, namely, the (1) *Colubridæ* and (2) *Vipers* or *Viperidæ*. All vipers are poisonous, but only two sub-families of colubrine snakes are decidedly poisonous, namely, *Elapinae*, and the sea-snakes (*Hydrophidæ*). Poisonous snakes are distinguished from non-poisonous by the presence of poison-glands. The poison-gland is usually situated one on each side of head above the upper-jaw and behind the eye, and it communicates by a duct with the poison-fangs, which are enlarged, channelled or 'perforated' teeth of the anterior maxilla. There is no sure way of distinguishing a poisonous from a harmless snake by external characters except by the dentition—the presence of grooved teeth—and an intimate knowledge of the various genera, and their head shields and scales, for which the zoological text-books should be consulted.¹

The chief points of distinction between the two families of poisonous snakes are roughly—

Poisonous colubrine snakes	Vipers
1 Body usually long and cylindrical	
2 Head small, seldom broader than body, covered by large scales or shields of special form or number	
3. Maxillary bone carries other teeth beside poison fang	Maxillary bone carries only poison fang
4 Eye has round pupil	Eye has vertically elliptic pupil

¹ Boulenger's *Reptilia*, Fauna of British India, 1890, or Fayrer's *Thanatophidia of India*, or Lwart's abstract of the latter; or Major P. Wall's (1885) excellent practical manual, *The Poisonous Terrestrial Snakes of British India*, Bombay, 1908.

The chief poisonous species of Indian land snakes are the following, the most common deadly ones are marked * *, the less common deadly ones *.—

COLUBRINE—

- | | |
|--|----------------------|
| ** Cobra, <i>Naja tripudians</i> Vern—'Nāga,' Keautia, 'Kala Sānp,' 'Gehusānp.' Throughout India and up Himalayas to 8000 feet | } Hooded elapine. |
| * Hamadryad or 'Tree-Cobra,' or 'King-Cobra,' <i>Naja</i> . | |
| * Bl | |
| * Banded Krait, <i>Bungarus fasciatus</i> . Vern.—'Sankhi,' or 'Raj-sānp,' growing to 6 feet or more | } Non-hooded elapine |

VIPERINE.—These are divided into 'vipers proper,' *Viperinae*, and the 'pit-vipers' or *Crotalinae*, the latter having a deep pit on each side of the snout between the eye and the nostril, and are confined to the hilly regions. The chief species are —

- | | |
|--|---------------|
| ** Russell's Viper, or the Chain-Viper <i>Vipera russelli</i> or <i>Daboia russelli</i> Vern—'Bora,' 'Tucpolonga,' 'Gunus,' growing to 5½ feet | } Viperinae |
| * Keel scaled Viper, <i>Echis carinata</i> Vern—'Fura' Afa, or 'Kapar,' attaining a length of about 2 feet | |
| * <i>Trimeresurus</i> , several species, terrestrial and arboreal
* <i>Ancistrodon hymale</i> or <i>Hypnale nepa</i> Vern—'Karavala' in Ceylon and W Ghats, south of Bombay, and <i>A himalayensis</i> from Sikkim to N.W | } Crotalinae. |

The cobra, hamadryad, and daboia are the most deadly of all snakes. After the cobra the great Russell's viper is the most deadly of Indian snakes, next comes the blue Krait, the little viper *Echis c* (with a dart-shaped whitish dark-edged mark on head), the great banded (blue and yellow) Krait (often confounded with the harmless *Lycodon fasciatus* of Assam and Burma), which is not very virulently poisonous, so little so that its bite is believed often to be non-fatal. The bite of the species of *callophis*, *trimeresurus*, and *ancistrodon* does not usually produce death in adult human beings and large animals.

Physical and chemical characters of snake venoms.—The physical characters and chemical composition of snake-venom differs to some extent according to the species and family to which the snake belongs. The venom of the cobra when freshly ejected is a light amber-coloured liquid like clear varnish of a specific gravity of about 1.046 and feebly acid reaction. It dries rapidly in the air into a yellowish film, like gum arabic, which tends to split up into bright yellowish scales

* In Assam *B. letulus*, in Ceylon *B. ceylonicus*, in Sikkim *B. niger*, and E. of Sikkim *B. lungravidus*

and granules. This yellow powder has an acrid odour and is an irritant to mucous membranes. It is soluble in water, the solution becoming actively toxic. The dried venom retains its activity for several years, and may be heated up to 100° to 125° without losing its poisonous properties. In 1883 Dr. Weir Mitchell showed that rattlesnake-venom could be split up by dialysis, etc., into two toxic principles, a peptone (albumose?) and a globulin, each with different properties; and he considered that differences in the action of snake-venom of different species of snakes depends upon the relative properties of these two substances. Norris Wolfenden applied this discovery to the venom of the cobra and Indian vipers, differentiating out several active constituents with different poisonous properties.

Action and symptoms of snake-venom.—The physiological effects of snake-venom differ to a considerable extent in kind according to the species or family to which the snake belongs. The broad differences between the symptoms of poisoning by the colubrine cobra and the vipers were described by the early Indian observers, especially Dr. P. Russell, Sir Joseph Fayrer, Dr. Wall,¹ and Dr. V. Richards. Their experiments were of a somewhat crude kind, the animals experimented upon usually receiving their poison by a bite from the snake, a method open to many fallacies. The more precise method of experiment by means of hypodermic injection of a measured quantity of fresh venom of ascertained strength and activity into a series of animals of given weights, and verified by control experiments, and *post mortem* examination was first employed in India by Dr. L. A. Waddell, in a large series of observations conducted at his own expense, with the result of indicating the remedial treatment of snake-bite by inoculation.² In the then absence of research laboratories in India the further researches on exact modern lines into the essential nature of cobra and Indian viper venom were a few years afterwards prosecuted in Europe with dried venom, notably by Lauder Brunton, Norris Wolfenden, Fraser, and latterly Calmette.

Snake-venom of both colubrine snakes and vipers has a local as well as a remote action. Locally it acts as an irritant to the tissues, and hence, when introduced into a wound, causes immediate burning pain in the wounded part, followed by swelling and inflammation. Even when applied to thin un-abraded membranes such as the conjunctiva, it acts as a local irritant.

¹ *Proc. Roy. Soc.*, 1881, Vol. XXXII, p. 333.

² *The Effect of Serpent-Venom, Sc. Mem. Med. Offrs.*, IV, India, Calcutta, 1899. See also pp 557-8

Its remote action is exerted mainly either on the nervous system, or on the blood, or on both; and may not only be the result of its absorption into the system from a wound, but may even result from its absorption through unabraded delicate membranes, such as the mucous membrane of the stomach.¹ The remote action of the poison of the cobra and other colubrine snakes and including sea-snakes,² seems usually to be mainly exerted on the nervous system, whilst that of the Indian vipers is especially upon the blood. These two classes of effects are attributed by Weir Mitchell respectively to the toxic *peptone* which acts more particularly on the tissues, causing inflammatory action with much swelling and extravasation of blood, whilst the globulin acts more particularly on the nervous system, paralyzing the heart and the respiratory centres.

Action on the nervous system.—An interval varying in duration usually elapses between the bite of a poisonous snake, and first appearance of nervous symptoms. In the human subject, this interval in cases of cobra-bite may be 15 minutes to about an hour, which is the average according to Wall,³ but may be longer, it is often longer in cases of bite by the less venomous snakes. In cobra-bite in the human subject (see *Case*, p. 587) the chief nervous symptoms are a feeling of intoxication, followed by loss of power in the legs, the patient *staggering or falling if he attempts to walk or stand*.⁴ The loss of power then spreads to other muscles, those of the tongue and larynx becoming early affected, and the powers of speech and deglutition are lost, the saliva trickles away, the power of expelling it having ceased, as in glosso-pharyngeal paralysis. The paralysis then becomes general, the respiration slow, and it becomes weaker and weaker till death occurs by asphyxia, due to gradual paralysis of the respiratory movements and the heart beating for some time after the respirations have ceased. Nausea and vomiting are often early symptoms, and asphyxial tremors (not convulsions, as the general paralysis precludes these) may precede death. The pupil, as a rule, is but little affected. Death seldom occurs before 20 minutes to half an hour, even when the largest doses are given. Very similar nervous symptoms usually follow the bite of other colubrine

¹ *Thanatophidia of India*, p. 64, L. A. Waddell in *Sc. Mem. Med. Offrs.*, IV., p. 26.

² For exhaustive experiments on the venom of sea-snakes, see *Physiological Action of the Poison of the Hydrophidae*, by L. Rogers, M.D., F.R.S., *Proc. Roy. Soc.*, 7th May, 1903, and reproduced in *Ind. Med. Gaz.*, pp. 269, etc., 1903.

³ On *Indian Snake Poisons*, p. 12.

⁴ Lauder Brunton considers that the terminations of the motor nerves are affected—*Proc. Roy. Soc.*, 1875 Vol. 22.

snakes, but as the poison is less active more chronic symptoms may develop.

Thus, Wall, in experimenting upon animals with the poison of

charges took place from the eyes, nose, and rectum, the urine became albuminous, and death occurred from exhaustion several days after the bite. In these cases, however, there was no tendency to hæmorrhage.

Daboia-bite also causes marked nervous symptoms, but the paralysis is more general, does not specially affect the tongue and larynx, and salivation is, as a rule, absent. Convulsions are often present early in the case, and the pupil is usually dilated. In **Echis-bite** the nervous symptoms are, as a rule, comparatively slight in severity. *Mental shock* may, to some extent, modify the nervous symptoms present in a case of snake bite; and from recorded cases it appears that the bite of a non-poisonous snake may give rise to mental shock so severe as to cause death.

Action on the blood in viper-poisoning.—Martin of Melbourne has shown that the very rapid deaths are due to an extensive intravascular thrombosis, especially of the pulmonary arteries, and this has been confirmed by Weir Mitchell in regard to the American vipers—the rattlesnakes. It has, moreover, been directly observed with respect to the great Indian viper, the *Daboia*, by Captain G. Lamb.¹ This intravascular thrombosis of the pulmonary arteries explains the cases, namely, the gasping and violent respiratory movement and violent

lost its power of coagulating, and this condition seems to account for the large bloody extravasation and œdema and bloody oozing at the site of bite, the extensive hæmorrhages from mucous membranes, ecchymotic patches, and adenæ which are such prominent symptoms of the more chronic cases of viper-poisoning.

Cobra-poison in laboratory experiments causes active hæmolysis and delays the blood from clotting. The poison dissolves out the hæmoglobin from the red corpuscles, but the poisoning danger as a rule ceases with the disappearance of the

¹ *Ind. Med. Gaz.*, 1901, p. 414.

nervous symptoms, whereas, with vipers, the blood-poisoning symptoms may continue for days after the nervous symptoms have disappeared, may end in death from exhaustion, and in *echis* poisoning are often the chief symptoms present. Further, owing to this special tendency to blood-poisoning, danger to life in cases of *daboia* and *echis*-bite may continue long after the nervous symptoms have been recovered from; while in colubrine snake-poisoning, danger as a rule ceases with the disappearance of the nervous symptoms.

Case.—Cobra-bite—accidental.—A coolie was bitten on the shoulder by a cobra about midnight. He immediately felt a burning pain at the spot bitten, which increased. In 15 minutes afterwards he began, he said, to feel intoxicated, but he seemed rational and answered questions intelligently. The pupils were natural, and pulse and respirations normal.

side to side, and the pulse and respirations were somewhat accelerated, but he was still conscious and able to answer questions. There was no paralysis of the arms. The breathing became slower and slower, and at length ceased one hour and ten minutes after the bite, the heart beating for about a minute after the respiration had stopped.

Case.—Russell's viper-bite—chronic.—A Mohammedan, aged 40, was bitten on the finger by a *Daboia*. The bitten part was excised soon after, and stimulants given. The hand and arm became much swollen, and on the same day he passed blood by the rectum and bloody urine. The next day he was sick, and still passing blood from both channels. In this state he remained eight days, constantly losing blood, and died on the ninth day.—*Ind. Med. Gaz.*, June, 1872.

Post-Mortem Appearances in Snake-Bite.—For the medical jurist the chief practical point is how to recognize snake-poisoning *post mortem*. Endeavour should be made to distinguish between Colubrine and Viperine cases. In Colubrine cases, *Cobra* or *Krait*, there is seldom much to indicate the site of the puncture. In some cases you may fail to find it. The blood is generally fluid and hemolysed, causing early staining of the vessels. There is very little definite to indicate the cause of the death.

In Viperine cases, *Daboia* or *Echis*, there is generally much discoloration, swelling, and infiltration, at the seat of the bite, and extensive cellulitis in its neighbourhood. Though the blood is usually found clotted in small animals, all autopsies in man have shown the blood fluid. There is often evidence of hæmorrhage into the bowel, purpuric spots on the pericardium and hæmorrhages may be found in many tissues.

Antidotes and treatment of snake-bite.—The appalling loss of life and the horribly sudden nature of the death from

snake-bite has always stimulated a search for antidotes. Of the many so-called 'antidotes' to snake-venom, however, permanganate of potassium was the only one that could be said to be of any use whatever, but even it is no true antidote, as it only destroys the venom when it actually comes into direct contact with it, and is powerless to counteract the poison once the latter has entered the circulation.

In 1888, as a result of a large series of experiments upon Indian serpents, undertaken expressly "to afford indications for combating the action of the venom on man," Dr. L. A. Waddell established the hypothesis that "immunity may be acquired by the imbibition of small doses of the venom,"¹ and in support of this view he instanced the then newly discovered (but still unformulated) doctrine of antitoxins, as demonstrated by Dr. Wooldridge in regard to anthrax protection,² in these words:—"The protection conferred by 'vaccine' being, it is alleged, attributable, in certain cases, to the action of the soluble chemical products resulting from the growth and development of the morbid germ."³ In reviewing Dr. Waddell's monograph the *Pioneer* on the 2nd April, 1889, in a long article said:—"Dr. Waddell propounds the theory that it is because the immunity is an acquired condition—a *toleration* to the venom established through the imbibition of small quantities of the venom . . . in other words, that the snake inoculates itself against the consequence of its own virus. And if the snake, why not the man; for that is the conclusion evidently to which Dr. Waddell means to work up. . . . Though after all it is a question whether it would be worth while for every one in India to be inoculated against the offchance of being bitten by a snake." Amongst the notices in European scientific journals of this research by Dr. Waddell on the artificial immunization against snake-venom, Professor Henry de Varigny gave an editorial notice of two columns in the *Revue Scientifique* of 22nd February, 1890, calling attention to its great practical import for India and other tropical countries, as a life-saving measure.

Dr. Waddell in concluding that monograph stated⁴ that he was about to submit his hypothesis with the antitoxin features to actual experiment. Circumstances, however, prevented his doing this himself, owing to no facilities whatever having been given him for this work by the Government; but over five

¹ *An Inquiry into the Effect of Serpent-venom, etc.*, *Sc. Mem. Med. Offrs.*, IV, 1889; also *Ind. Med. Gaz.*, May, 1889, p. 147. See also review in *Pioneer*, 2nd April, 1889, and in *Revue Scientifique*, Paris, 22nd February, 1890.

² *Proc. Roy. Soc.*, 1887, p. 313.

³ *Op. cit.*, p. 27.

⁴ *Op. cit.*, p. 28.

years later, M. Calmette¹ and Professor Fraser carried out the necessary experiments, after the antitoxin theory had become much more developed; and the protective antitoxin for snake-venom thus obtained is called 'Serum Antivenimeux' or 'autivenene.' It is the serum of the blood of animal (usually a horse) which has been rendered immune against serpent venom by repeated injections of the venom.

This 'antivenene' seems to have undoubted antidotal properties for cobra-bite, as it is prepared for cobra-venom. It has, however, little if any value against viper-venom, which has been shown by Wall, Richards, Waddell, Wolfenden and Martin to have a different chemical composition and physiological action from cobra-venom; and Cunningham in 1896 by direct experiment found that "the antidotal material (antivenene) contained in the blood of animals which have been artificially immunized against colubrine (cobra) venom is inert against viperine venom, and *vice versa*."² Latterly in the production of antivenomous serum a mixture of colubrine and viperine poison is used in the proportion of 80 of the former to 20 of the latter, and a supply of this new serum is now issued to every civil station and regiment throughout India. It rapidly deteriorates.³

The local treatment, however, should never be neglected, namely, the immediate sucking of the wound, ligaturing the limb above the bite and applying freely an alkaline solution of permanganate of potassium with free scarification, excision of bitten tissue, and laying open the wound so that it bleeds freely—this last perhaps is the most important of all. And if the severer symptoms set in, an attempt to maintain breathing should be made by artificial respiration and galvanism.

The permanganate treatment is adversely reported on by the authoritative experimenters Lamb and Bannerman. The latter writes (*I G M.* 1912, 381, etc.)

The treatment of snake-bite by potassium permanganate was first used by Sir Joseph Fayrer, M.S., in 1869, who found that the drug "did not seem to have any power to avert the lethal action of the poison." Wynter Blyth showed that when mixed *in vitro* with permanganate of potassium, cobra venom became innocuous. In 1881 Couty and Lacerda performed certain experiments, showing that the lethal action of serpent's venom was destroyed when a 1 per cent. solution of the drug was injected into the tissues close to the place of bite. In

¹ Calmette's announcement was first made in February, 1894.

² *British Med Jour*, 15th June, 1895. See *Memoirs*, IX, pp 1-30.

³ G. Lamb, M.S., *ib.*, N.S., p 11, 1902.

1902 Lauder Brunton introduced the well-known "lancet," in the hope that in this simple method lay a treatment for snake-bite which would be of great life-saving value. Rogers reported promising results from experiments on various animals. Lamb, on the contrary, conducted experiments which were not successful. The present investigation was instituted to obtain evidence as to the efficacy of the treatment *in vivo*.

It was decided that in the first series of experiments natural conditions of biting should be imitated as closely as possible. The test dose was that given by the actual bite of the Cobra or Daboia, and it is to be noted that the Cobra, after having bitten, remains attached to his prey for an appreciable time. The latter snake occasionally

Surgeon-General Bannermann's experiments showed that—

(1) A dog bitten by a cobra cannot be saved by the local application of powdered potassium permanganate rubbed in after free incision of the bitten place; nor by a similar application of a solution of the powder.

(2) That it may be saved by the immediate subcutaneous injection of 10 c.c. of a 5 per cent. solution of the drug; but that this solution is so strong as to act as an escharotic.

(3) That if this treatment be delayed for even two minutes, it loses its efficacy.

(4) That a dog bitten under natural conditions by a Russell's viper (*Daboia*) cannot be saved by the drug, however applied.

"The conclusions as to the action of potassium permanganate powder on small doses of cobra venom injected *just under the skin* appear to be that this treatment is of some little use under these highly artificial conditions. It must be remembered, however, that a snake does not deposit its venom under the skin, but striking as it does with its fangs at right angles to the skin, the poison must usually be placed well below the fascia of the part, and therefore further removed from the applications of a chemical antidote." "With regard to *Daboia* venom injected just under the skin, the results are very similar to those obtained with the venom of the cobra, i.e. that under such artificial conditions the treatment by free incision and rubbing with powder of potassium permanganate is of some little use. As a practical measure for employment after actual snake-bite it appears to be of no use whatever."

Should the situation of the bite permit, at once apply a ligature above the bitten part. Wall strongly recommends that this should be a thick indiarubber cord or band, wound

several times tightly round the limb¹. Failing this, two or three ligatures, at intervals of a few inches apart, should be, as recommended by Fayrer, tied round the limb, and the one nearest the bite tightened by twisting with a stick. Then using, if necessary, a lens, examine the part supposed to have been bitten. Usually two scratches, short cuts, or punctures, under one inch apart, will be found. Sometimes the punctures are very minute and barely visible, a drop or two of blood or serum indicating their position. The situation of the poisoned wound having been made out, free excision should at once be resorted to. The excision should include not only a portion of the skin about one and a half inches square, but also the underlying tissues for some little depth. As recommended by Wall, the areolar tissue below and around the excised portion of the skin should be dissected away freely, and on parts into which, from their situation, the fangs are able to sink in deeply, the excision should be carried still further. Thus, on the fingers or toes, the soft parts should be excised down to the bone, or the finger or toe amputated, and if the bite is on the ball of the thumb, the fascia and a portion of the muscle should be included. After excision, the wound should be washed with solution of caustic potash or potassium permanganate, and the ligature removed. The subsequent treatment may consist of the administration of stimulants, the employment of cold affusion, the use of artificial respiration (if there is a tendency to asphyxia), and general treatment of the symptoms as they arise. Main reliance must, however, be placed on early and free excision².

Cattle-poisoning by snake-venom.—The cattle of villagers are occasionally criminally poisoned by skin-workers for the sake of their hides. Snake-venom has been found by Hankin, in several cases, on pieces of rags taken from the rectum of dead cattle, in the United Provinces. It is stated that a cobra is placed in an earthen vessel with a banana. Heat is applied

¹ Wall points out that after an incision has been made through the skin examination of the parts below will reveal to an experienced eye if injection of venom has taken place, and that any signs of irritation indicative of the wound being something more than a mere mechanical puncture, should be taken as showing that the individual has been poisoned as well as bitten.

² Several chemical substances, e.g. potassium permanganate, destroy the activity of snake poison if mixed with it previous to its introduction into the body. These, however, only do so owing to their general action on organic matter. Hence, once the poison has been introduced into a wound, these substances, owing to their having no special affinity for the poison, are practically useless as remedial agents. So also are the so called snakestones, i.e. stones which are reputed to have the power of sucking out the poison when applied to the wounded part.

to the vessel. The snake being irritated bites the banana. The banana is then taken out and crushed to a pulp which is spread on a piece of rag. The rag is inserted into the rectum of an animal by means of a piece of split bamboo. In some cases after the death of the animal snake poison can be detected on the rag by means of the test described in the following paragraph. The juice of madar (*Calotropis gigantea*) appears occasionally to be used in a similar way instead of snake-venom.

Test for snake-venom.—A small quantity of the watery solution or extract from a suspected rag, etc., sufficient to kill, should be injected into two fowls or rabbits, a different dose in each, and the same quantities mixed with antivenene, in which latter case the animals operated on should remain unaffected.

Venomous Insects.

Scorpions.—These have in the last joint of the tail a hollow sting, communicating with a poison-secreting apparatus, and serving, like the poison fang in snakes, to convey venom into wounds made by it. The local irritant action of the venom is always very severe. Five children died from scorpion sting in Bongal during the three years ending 1872; and from cases quoted by Chevers it would appear that the sting, at any rate of the larger varieties, may cause death in adults. The darker variety is said to be more deadly. **Centipedes and spiders** are also provided with a poison-injecting apparatus connected with their jaws or mandibles. The bites of these cause effects very similar to those produced by the sting of a scorpion. The bite of some varieties of spider appears to cause severe constitutional symptoms, and may even cause death. **Wasps, bees and hornets** are all provided with a poison sting. A single sting from one of these is not likely to cause serious effects, except in cases where it goes directly into a vein, or where inflammation and swelling of the part stung interferes with some important function, e.g. respiration. Taylor mentions, however, two cases in which adult females died from shock after, apparently, a single sting of respectively a wasp and a hornet. A number of stings, as in cases where persons are attacked by a swarm of wasps or bees, have frequently caused severe constitutional disturbance, occasionally ending in death. Lizards, contrary to the popular belief, at least those which, up to the present, have been met with in India, are not venomous.

Cantharides, the dried *Cantharis vesicatoria*, blister beetle, or 'Spanish fly,' applied to the skin, causes irritation and

vesication, and when swallowed or absorbed into the system in poisonous doses, gives rise to the usual symptoms of irritant poisoning, accompanied, when the poison has been taken by the mouth, by blistering of the mouth and throat. A case of cantharides poisoning by the vapour emitted from a bottle of hairwash containing cantharidine was reported by Dr. Islay B. Muirhead, of London, in 1906, in which a person occupying the same room, and who did not use the wash, was affected by the fumes. The evacuations usually contain blood. Special symptoms in poisoning by cantharides are: (a) salivation, with swelling of the salivary glands and back of the throat, rendering swallowing painful and difficult; and (b) strangury, hæmaturia, inflammation of the genitals and other similar symptoms, due to the special irritant action of the poison on the kidneys and urinary passages. In fatal cases convulsions generally precede death, insensibility may or may not be present. Cantharides is seldom administered with homicidal intent, cases of poisoning by it are usually accidental, or arise from its being given as an abortifacient, or as an aphrodisiac. As an abortifacient, cantharides often fails, but sometimes succeeds, owing to the violent constitutional disturbance produced. There is no proof that the drug has any specific action on the uterus. As regards aphrodisiac action, the drug may possibly excite sexual passion, but it is only likely to do so when given in quantity sufficient to endanger life or cause serious symptoms. Taylor¹ mentions an English case (*R. v. Wilkins*, Liverpool Lent Assizes (1861)) where a man was tried and convicted of administering powdered cantharides to a woman, in which the question arose whether or not an offence had been committed, seeing that the drug had been given solely with the motive of exciting sexual desire. Mayne, in his commentary on s. 328 of the *Indian Penal Code*, refers to this case as follows: "In a case under a similar English statute, where it appeared that the prisoner had administered a drug to a female with intent to excite her sexual passions, in order that he might have connection with her, the conviction was affirmed." Dose, etc.—The medicinal dose of powdered cantharides is one to two grains, and of the tincture (strength one to eight) five to twenty minims. The smallest fatal doses recorded are of the powder, twenty-four grains, and of the tincture, one fluid ounce. Recovery has, however, taken place from six ounces of the tincture, and in another case from sixty grains of the powder. The shortest fatal period recorded is twenty-four hours, and the longest (from one ounce of the tincture) seventeen days. Taylor mentions a case where death, with the usual symptoms of cantharides poisoning,

¹ *Prisoners*, p. 529.

resulted in five days, from the external application of cantharides ointment, in mistake for sulphur ointment, as a cure for itch. **Treatment.**—General. Only demulcents should be avoided, as cantharidin, the active principle, is soluble in oil. Opiate injections into the bladder, opium suppositories, and warm baths should be used to relieve pain. *Post mortem* appearances—These are usually alimentary canal, congestion of of the urinary passages. When ~~the powder has been~~ glittering particles of it may be found adhering to the intestinal mucous membrane. Similar particles may be found in the vomited matters. ~~It is a~~ colour, and contain

These resist putrefaction, and may be detected in the contents of the intestines after long periods of interment. The active principle, cantharidin, present in the powder to the extent of about one-half per cent, may be extracted therefrom, or from organic mixtures in that it is soluble in these by acidulation. On separating and he recognized in the of oil, and applying cantharidin is present, vesication will be produced. Cantharidin is also present in the *Myiabras cichorii*, or *Telini fly*, officinal in the L.P., as a substitute for cantharides, and possessing exactly the same action. The powder of these differs, however, from cantharides powder in containing no shining particles. Cantharidin has also been found in various other Indian blistering flies, e.g. in the *Myiabras pustulata* and *M. punctum*.

POISONS GENERATED BY DEAD ANIMAL TISSUES.

Poisonous Animal Food.

Poisoning by Putrid Meat.—An intoxication, with symptoms more or less resembling those of poisoning, may arise from eating meat which (1) contains ptomaines or toxalbumoses, (2) conveys a true infection by pathogenic bacteria, septic or from sewerage, etc., (3) is infested by gross parasites

(tape-worm, etc.), (4) is poisoned by metallic salts from imperfectly tinned cooking pots or zinc or copper vessels. It most commonly occurs from eating old preserved canned or tinned meat, and often from sausages, hence the term 'sausage-poisoning,' or Botulismus; but it also occurs from other stale tinned meats, and may also occur from vegetable food.¹ In the first two classes, besides the usual irritant symptoms, there is usually dryness of the skin and mucous membranes, and the narcotic symptoms of ptomaines, dilatation of the pupils, and paralysis of the upper eyelids. In cases where the symptoms do not develop for some time, but commence from 12 to 50 hours after the consumption of the tinned meat, they are due to bacteria, there is generally fever, the digestive troubles are more like those of gastro-enteritis, and sometimes there is blood in the evacuation, and there may be pleuropneumonia, as in the Middlesborough epidemic of 1880, in which 490 persons died, and a pneumonia bacillus was isolated. Some of such meat when examined contains such a number of dead cocci and bacilli as to bear all the appearance of an artificial culture-broth. A *Bacillus botulinus* was found by Van Ermengen in a case of food-poisoning from raw ham, and a microbe like the *B. enteritidis* of Gaertner in the Bhowanipore epidemic of 1903 by Nield Cook.²

Cheese and milk.—In more than one case symptoms of irritant poisoning have been produced by eating cheese. In such cases the cheese eaten has generally, but not invariably, been found to be rancid and to contain *tyrotoxinon*, which is obtained as needle crystals by alkalinizing and shaking with ether. It is not an alkaloid, but is considered by Vaughan to be diazobenzene and to be a product of micro-organism in the milk. In decayed cheese as well as in the milk of deceased cows a poisonous ptomaine or toxalbumose has been found.

Poisonous fish.—Many cases, a few of them ending fatally, have been reported, in which persons have been attacked with symptoms of poisoning after eating fish, especially stale or tinned fish. In some of these cases the symptoms have appeared within a few minutes, in others not until twelve or twenty-four hours, or more, after eating the fish. One or both of two sets of symptoms may be present, viz (1) the usual symptoms of irritant poisoning and (2) swelling and inflammation of the

¹ An outbreak of severe diarrhoea in a Bengal jail was traced to the maize in the food.—W. J. Buchanan, F.R.S., in *Ind. Med. Gaz.*, 1900. And an attack of so-called cholera in Lord Hastings' camp in 1817 was attributed to unwhole some rice.—Charters, *M. J.*, p. 301. But see Lathyrism and Poisonous Food grains.

² *Ind. Med. Gaz.*, 1903, p. 262.

eyelids, with profuse lachrymation accompanied by irritation of the skin and appearance of an eruption resembling nettle-rash. In some cases muscular debility, numbness of the limbs, delirium, and coma have been observed. Death has occurred within the hour, and has been delayed until the ninth day.

Cases of fish poisoning may be divided into four classes :

(1) A peculiar *idiosyncrasy*, rendering the fish poisonous only to the individual attacked, and not to others ; (2) fish usually non-poisonous, becoming copper ; (3) food (e.g. to the dog etc. Cases of this kind are due to shell-fish, especially mussels and (2)

skin glands of certain species of amphibia has been found to be poisonous. Blyth mentions that a poisonous alkaloid has been found in the skin secretions of the *Salamandra maculosa*, the *Triton cristatus*, or water salamander, and the common toad

Ptomaines.

Ptomaines are chemical products of bacterial life in dead animal tissues, and as they are found by *post mortem* decomposition, they have been called 'cadaveric alkaloids,' or ptomaines produced by

in the food, as has been already noted. It is, therefore, quite possible that in the body of an individual, who has died from some other cause than poisoning, there may on examination be found an alkaloid, which, when tested by administration to an animal, proves to be poisonous. Some of these ptomaines have been found to possess a physiological action similar to that possessed by certain vegetable alkaloids, e.g. strychnia and atropine (*ptomatropine*). No ptomaine, however, has as yet been discovered possessing all the exact chemical characters of vegetable alkaloids, which are capable of being identified by

distinctive chemical reactions.¹ Hence, the objection that an alkaloid discovered in a case of supposed poisoning may be a ptomaine produced by decomposition after death, mainly applies to cases in which the vegetable alkaloid, supposed to have been discovered, is one which can only be recognized by its physiological action, though none have yet been found to possess the peculiar tingling sensation of aconitine when applied to the tongue.

Diseased Meat.

In cases of diseased meat, the disease may or may not consist in the presence of a parasite in the meat. The parasites, the presence of which in meat most commonly gives rise to cases, are the *trichina spiralis* and the various *systiceri*.

Trichina spiralis.—Meat affected by this parasite contains, lying among the muscular fibres, small oval sacs, just visible to the naked eye,² each containing a coiled-up trichina (see *Plate IV.*, fig b). Sometimes these sacs are so numerous as to give the meat a white speckled appearance. When meat thus affected is eaten without having been thoroughly cooked, a train of symptoms known as trichinosis is produced.

The pathology of trichinosis is briefly as follows: the trichina, while enclosed in its cyst, is in a chrysalis condition. When the cysts are taken into the stomach or intestines of a warm-blooded animal, the trichina leaves the cyst and begins to produce young. Six to eight days after the ingestion of the cysts these young trichinae begin to leave the parent animal, and to migrate through the wall of the intestines into the muscles, where they, in their turn, become encysted, and live by preying on the muscular fibre. The symptoms of trichinosis resemble, to a certain extent, those of irritant poisoning, differing from an ordinary irritant case chiefly as follows: (1) there is generally a considerable interval, corresponding to the period of incubation

¹ A strychnine-like alkaloid has been obtained from a corpse (Mecke and Wimmer *Pharm. Zeit.*). The alkaloid obtained forms white nodular crystals, its hydrochloride feathery tufts. It reacts like strychnine with picric acid, potassium dichromate, sulphuric and nitric acids, tannin, potassium ferricyanide, potassium thiocyanate, and after evaporating with chlorine-water it gives a dirty green with ammonia. With Froehde's reagent it yields first a dirty violet, then an olive, and finally a green colour. With sulphuric acid a yellow, which changes to cherry red, and then to rose, with Erdmann's reagent, a yellow colour. It is only slightly bitter to the taste, and has no physiological action on frogs.—*Treatment*, 250.

² Taylor gives the measurement of the sacs as $\frac{1}{16}$ th of an inch long by $\frac{1}{16}$ th of an inch broad. The worm varies in length from $\frac{1}{16}$ th to $\frac{1}{4}$ of an inch. As many as 600 may be found in about sixteen grains of the affected meat.

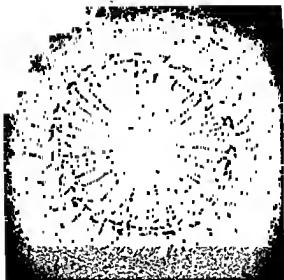
of the worm, between eating the food and full development of the symptoms. (2) Although the pain in trichinosis is intense, the vomiting and purging are not very severe; and the pain is not confined to the stomach and intestines, but extends to the muscles as well, owing to the invasion of these by the trichinæ. (3) In trichinosis, pneumonia is almost a constant symptom; there is often, also, peritonitis, and sometimes paralysis of the muscles. Several outbreaks of trichinosis have been reported, chiefly in Germany, the most notable being one which occurred, in 1863, in which 103 persons were attacked, of whom eighty died. There is no remedy, but it should be noted that trichinæ are destroyed by exposure for some time to the temperature of boiling water, and hence thorough cooking of trichinous meat prevents the occurrence of trichinosis. Trichinæ are more frequently found in the flesh of the pig than in that of any other animal, hence cases of trichinosis have generally occurred from eating imperfectly cooked pig's flesh in some form or other. In affected animals trichinæ, it is said, will always be found in the muscles of the eye.

Cysticerci.—These are the larvæ of tapeworms, and may be found in the flesh of all animals. Flesh containing them is popularly termed 'measly,' e.g. measly pork.

In affected meat the cysticerci are seen as little sacs, filled with fluid, embodied in the muscle. From one side of the interior of the sac a neck projects, terminating in a head surmounted with a crown of hooks (see *Plate VI., a and b*). The pork cysticercus (*C. cellulosæ*) varies in size from a pea to a large bean, and develops into the *Tænia solium* (6 to 12 feet long). The cysticercus of ox flesh is smaller in size, and develops into the *T. mediocanellata* (15 to 20 feet or more). Both these tapeworms affect the human subject. In rare cases also, the larval form of *T. solium* has been found in the human body. Another variety of tapeworm, *T. echinococcus*, is only known to affect the dog and wolf; the larval form of this tapeworm, however, affects other animals, e.g. sheep, in which it specially affects the brain, causing 'staggers,' and the human subject, giving rise to hydatid tumours. Woodman and Tidy remark that *echinococcus* disease is alarmingly common in Iceland.

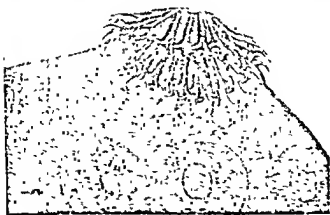
Other diseased meat.—The flesh of animals affected with disease not specifically parasitic in character may also, when eaten, give rise to symptoms resembling those of poisoning. Thus, Dr. Letheby met with a case in London in which sixty-four persons, of whom one died, were attacked with sickness, diarrhœa, and great prostration of strength, after eating

a



HOOKLETS OF CYSTICERCUS $\times 63$

b



HEAD OF CYSTICERCUS $\times 63$

(from Microphotography by H. Wilder)

To face p. 100

sausages made from diseased beef. In another English case, which occurred at Welbeck in 1880, over seventy persons, of whom four died, were attacked with similar symptoms after eating ham found, on examination, to contain a bacillus. In the great majority of the Welbeck cases of which particulars could be obtained, the symptoms did not appear until twelve hours or more after eating the affected food. A bacteriological examination should be made in such cases.

CHAPTER XXVIII.

NERVE POISONS.

THESE may for descriptive purposes be divided into cerebral, spinal, cerebro-spinal, cardiac, etc. (see Table, p. 439).

Cerebral Poisons, Opium, etc.

Generally the poisons of this order, including narcotics, anæsthetics, inebriants and delirians, act mainly on the brain, causing one or other of two sets of symptoms or both. These, in the order
quick pulse and
delirium, and
and (2) Sopor, deepening into more or less profound coma, with laboured and stertorous breathing.

The mydriatic delirians produce the first of these two sets of symptoms, accompanied by dilatation of the pupils, as their prominent effect. The majority of poisons of this order—narcotic poisons—produce the second set of symptoms as their prominent effect. In poisoning by some of these, *e.g.* alcohol, a first stage of excitement and delirium usually precedes the second or comatose stage; but when the dose is large, this first stage may be absent. In others, *e.g.* opium, the first stage is commonly absent, or only slightly marked; but, if the dose is small, or the patient habituated to the action of the poison, a well-marked first stage may be present. A few, *e.g.* hydrocyanic acid and the poisonous cyanides, act with extreme rapidity, paralyzing the heart if the dose is large, and causing death by syncope; or in smaller doses, acting on the spinal cord as well as the brain, and although producing insensibility, quickly causing death by asphyxia due to paralysis of the muscles of respiration, and not by coma as is usual in cerebral poisoning.

No chemical antidote is available for the majority of these poisons, hence, in most cases, the treatment must consist in the use of measures directed to (a) procuring elimination of

the poison, and (b) counteracting its effects. If the poison, as is usually the case, has been administered by the mouth, the first of these indications may be carried out by giving emetics or using the stomach-pump; the latter being resorted to in preference to repetition of the emetic, seeing that many of these, *e.g.* zinc sulphate, if not ejected by vomiting, are liable to become absorbed and act as poisons. The measures by which the second indication of treatment may be carried out vary according to the poison and the prominent symptoms. Thus, cold effusions, keeping the patient roused, sinapisms, etc., are indicated when narcotism has to be overcome; and galvanism and artificial respiration when death threatens to occur by asphyxia. In the case of some cerebral poisons, special physiological antidotes are indicated, *e.g.* atropia in opium poisoning.

Opium and Morphine.

Opium, *Aṣṡm*, *Aṣṡyūn* (Hind.), is the inspissated juice obtained by incision from the unripe capsules of the poppy, *Papaver somniferum*, N O *Papaveraceæ*. It contains meconic acid and a number of alkaloids, those present in largest quantity being narcotine and morphine.

Indian opium, as a rule, contains more narcotine than morphine. Other varieties, as a rule, contain more morphine than narcotine. Of these two alkaloids, narcotine has no narcotic properties, and is official I P as a tonic and antiperiodic. Morphine, on the other hand, is a powerful narcotic. The percentage of morphine in different samples of opium varies from about 2½ to 15 or even 20 per cent. Indian opium often contains under 5, and seldom contains over 9 per cent of morphine. Other alkaloids present in opium, *e.g.* codeine, narceme, and papaverine, also possess narcotic properties. Another alkaloid, thebaine, the proportion of which to opium varies, seldom however, exceeding 1 per cent., is a convulsant like strychnia, but less powerful.



FIG 51.—Capsule of Opium Poppy
(natural size)

Opium is so easily obtained everywhere in India and by its means the 'thin spun life' can be slit with such ease and freedom from physical suffering that after strangulation, it is the most favourite means of suicide. In suicidal cases the opium is often mixed with mustard-oil in the belief that the latter facilitates the speedy action of the opium.

Of cases of poisoning in India nearly 40 per cent. of the deaths reported to the chemical examiners are due to opium. Such cases in adults are as a rule suicidal, and these are mainly

amongst women, chiefly mistresses or demi-monde, deserted by their lovers, though a considerable number are 'failed' students. Homicide for the reasons already given is rather rare by opium. In very young children suicide is, of course, excluded, and cases are either accidental or homicidal. The practice of drugging young children with opium by ayahs and nurses, in order to keep them quiet, is widely prevalent in India, and often results in cases of the first description. So also, but less directly, being often reported in in which the opium is killed. Poisoning by opium is a somewhat common method of infanticide in India.¹

In England, according to statistics collected by Blyth, in the five years ending 1890, altogether 1581 deaths were reported from poison. Of these, 643, or 40·7 per cent., were due to opiates. Of the 643 deaths,

its place being taken by datura.

Symptoms.—When solid opium has been swallowed, there is usually an interval of half an hour to an hour before the symptoms appear. A shorter interval than this is sometimes observed, especially when the drug has been taken in solution on a nearly empty stomach. In other cases, the interval has been several hours in duration. Intoxication appears frequently to delay the appearance of the symptoms; but in one exceptional case, reported by Christison, the appearance of the symptoms was delayed for eighteen hours without any apparent cause. At first there may be slight excitement, this, however, is soon followed by giddiness and drowsiness succeeded by sopor, gradually deepening into coma, with low stertorous respiration. The breathing gets more and more shallow, and finally death occurs, usually from paralysis of the respiratory muscles. The face is usually pale, the lips livid, and the skin bathed in perspiration. All the secretions (that of the skin excepted) are more or less completely suspended. The pulse may be at first natural or quickened; afterwards it is usually slow, but becomes small, quick, and irregular as death approaches. An odour of opium may be present in the breath. The pupils are contracted and insensible to light, but towards the end become widely dilated.

Rare symptoms.—*Vomiting* and even *diarrhœa* are sometimes present. Tetanoid convulsions and lockjaw have been observed, more particularly in children, and when morphine has been taken. Guy also includes delirium, anæsthesia, and paralysis, as occasional symptoms. In rare cases the symptoms assume a *remittent form*, the patient, after several hours' insensibility, recovering consciousness, but relapsing after an interval into coma, terminating fatally (see following case).

Case—Case of the Hon. Mrs Anson—"This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of an hour emetics were given, but she did not vomit for half an hour, and she was not treated medically for two hours and a half. The matter then drawn from the stomach had no smell of laudanum. She was quite unconscious, and had lost the power of swallowing. After remaining in this comatose state for upwards of nine hours the patient revived, her face became natural, the pulse steady, the power of swallowing returned, she was able to recognize her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes, the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."

Unusual modes of administration.—A case is reported of death from application of a poultice to the abdomen containing about one ounce of laudanum.¹ Serious symptoms have arisen from the application of opium to a wound. Death has occurred from the application of morphine to a wound; also from hypodermic injection of morphine, and from the injection of an enema of opium into the rectum. The introduction of opium into the vagina may cause death, and is a not uncommon method of attempting suicide in some parts of India.

Case—Opium poisoning, homicidal, in children.—In 1889 the mother of a female child about two months old left her child in the verandah of
er On returning
had come during

hand. The woman then
and died within a few hours. Opium was detected in the viscera of the child, and the rag on which the accused woman wiped her finger was also found to bear stains of opium. The bread which the accused held in the left hand contained no opium. The mother wiped the mouth of the child, when it vomited, with a piece of cloth, which was also forwarded for examination, and in the stains on which opium was detected.
—L. A. Waddell, *Beng. Chem. Ex. Rpt.*, 1899.

nursing another child; the mother of the latter child took the deceased on her lap and went out, when the deceased began to cry. The mother

¹ Tardieu, quoted by Blyth, p. 238.

amongst women, chiefly mistresses or demi-monde, deserted by their lovers, though a considerable number are 'failed' students. Homicide for the reasons already given is rather rare by opium. In very young children suicide is, of course, excluded, and cases are either accidental or homicidal. The practice of drugging young children with opium by ayahs and nurses, in order to keep them quiet, is widely prevalent in India, and often results in cases of the first description. So also, but less directly, does the habit of opium eating, cases being often reported in which children, getting hold of the box in which the opium is kept by their parents, eat a quantity and die. Poisoning by opium is a somewhat common method of infanticide in India.¹

In England, according to statistics collected by Blyth, in the five years ending 1880, altogether 1581 deaths were reported from poison. Of these, 643, or 40·7 per cent., were due to opiates. Of the 643 deaths, 160 occurred in infants, two of these were cases of homicide. Of the adult cases, none were homicidal, and about 27 per cent. suicidal. In England drugging with opium is occasionally adopted for the purpose of facilitating robbery, it is seldom, if ever, used for this purpose in India, its place being taken by datura.

Symptoms.—When solid opium has been swallowed, there is usually an interval of half an hour to an hour before the symptoms appear. A shorter interval than this is sometimes observed, especially when the drug has been taken in solution on a nearly empty stomach. In other cases, the interval has been several hours in duration. Intoxication appears frequently to delay the appearance of the symptoms; but in one exceptional case, reported by Christison, the appearance of the symptoms was delayed for eighteen hours without any apparent cause. At first there may be slight excitement, this, however, is soon followed by giddiness and drowsiness succeeded by sopor, gradually deepening into coma, with low stertorous respiration. The breathing gets more and more shallow, and finally death occurs, usually from paralysis of the respiratory muscles. The face is usually pale, the lips livid, and the skin bathed in perspiration. All the secretions (that of the skin excepted) are more or less completely suspended. The pulse may be at first natural or quickened; afterwards it is usually slow, but becomes small, quick, and irregular as death approaches. An odour of opium may be present in the breath. The pupils are contracted and insensible to light, but towards the end become widely dilated.

¹ *Beng. Medico-legal Rept. for 1870* states that in the three years ending 1872, thirty cases of infanticide by addition thirty-seven cases of alleged majority were probably opium cases.

Rare symptoms.—*Vomiting* and even *diarrhœa* are sometimes present. Tetanoid convulsions and lockjaw have been observed, more particularly in children, and when morphine has been taken. Guy also includes delirium, anesthesia, and paralysis, as occasional symptoms. In rare cases the symptoms assume a *remittent form*, the patient, after several hours' insensibility, recovering consciousness, but relapsing after an interval into coma, terminating fatally (see following case).

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... she was able to recognize her daughters, and in a thick voice to give an account of the mistake she had made. This state lasted about five minutes, the torpor then returned, she again sank into profound coma, and died in fourteen hours after the poison had been taken."

Unusual modes of administration.—A case is reported of death from application of a poultice to the abdomen containing opium.¹ Serious symptoms from opium to a wound. Death from morphine to a wound; also from hypodermic injection of morphine, and from the injection of an enema of opium into the rectum. The introduction of opium into the vagina may cause death, and is a not uncommon method of attempting suicide in some parts of India.

Case—Opium poisoning, homicidal, in children.—In 1889 the mother of a female child about two months old left her child in the verandah of her house in Situmari, while she went to fetch water. On returning she found the child dead. The child was found lying on its back, with its mouth open, and its hands and feet stiff. The mother was arrested, and the child was examined. The child was found to have vomited, and the rag on which the accused woman wiped her finger was also found to bear stains of opium. The bread which the accused held in the left hand contained no opium. The mother wiped the mouth of the child, when it vomited, with a piece of cloth, which was also forwarded for examination, and in the stains on which opium was detected. —L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case—The civil surgeon of Patna forwarded the viscera of a Hindu male child, aged about six months who was found to have met his death by opium poisoning to the police:—"The deceased was found lying on her lap and went out, when the deceased began to cry. The mother

¹ Tardieu, quoted by Blyth, p. 253

of the deceased, suspecting something wrong, took her child from the woman and brought it home, but the child died within a few hours." Opium was detected in the viscera of the child. Both of these cases occurred in the districts where opium is cultivated in Upper Bengal.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Case.—Opium f
Calcutta a Jew was
cut on the throat.

but finding life still prolonged, had recourse to the knife to hasten his end. Obviously, in cases of this description, there is no opium odour in the breath.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1897.

Case.—Poisoning by applying opium to a wound.—A Burman boy was struck on the forehead with a knife. This the parents, finding the boy was not recovering, applied grains of opium to the wound. H. W. Jones) in a paper on opium poisoning. ment.—Chevers, *Med. Jur.*, p 223.

Diagnosis.—1. From apoplexy. Here the chief points of distinction are: (a) The age and appearance of the patient. Apoplexy generally, but not invariably, attacks the old, and it is more common in fat than in thin persons. (b) The history of the case. In apoplexy the patient comes on abruptly; in opium poisoning the patient comes on gradually.

(c) The pupils. In apoplexy of the pons *varolii*, when they are contracted. In opium poisoning, the pupils are contracted except towards the end of the case, when they become dilated. (d) The odour of the breath. This, however, may be absent in opium poisoning. (e) Convulsions, a bloated face, and impossibility of rousing the patient, are all more in favour of apoplexy than in favour of opium poisoning. 2. From uræmic coma.—Here chief reliance would be placed on (a) the history of the case; (b) the presence in, or absence from, the urine, of matters indicative of disease of the urinary organs; (c) the state of the pupils, contraction pointing to opium poisoning; and (d) the presence or absence of an odour of opium in the breath. 3. From other narcotic poisoning.—Alcoholic poisoning is sometimes difficult to distinguish from opium poisoning. In the first, the pupils are usually dilated, but may be contracted; and there is often an odour of alcohol, and not of opium, in the breath. In poisoning by carbolic acid, the pupils, as in opium poisoning, are contracted; here, however, the local action of the poison on the lining membrane of the mouth would most probably serve to distinguish the case. Contracted pupils, also, are present in poisoning by Calabar bean, may be present in aconite poisoning,

and also, except during the fits when the pupils are usually dilated, in poisoning by strychnia. The three poisons last mentioned, however, are not narcotic in action.

Fatal dose: This is affected by:—1. Age—Children are extremely sensitive to the action of this drug. 2 Habit.—Persons in the habit of taking opium, or its preparations, acquire a resisting power to its action; *e.g.* a case is on record of an opium eater who was in the habit of swallowing nine ounces of laudanum (tincture of opium) daily; and another of a lady, aged twenty-six, who took ten grains of acetate of morphine three times a day for ten years. 3. Disease.—In some diseases, *e.g.* tetanus, tities of disease, 4. Idiosyncrasy—Some persons are easily affected by small doses of opium, others are but little affected by large doses. 5. Quality of the drug.—As already pointed out, the percentage of morphine in opium varies greatly. Garrod, however, remarks that, although good opium contains one-tenth of its weight of morphine, morphine is not ten times, but only about four times, as strong as opium. Hence, although ordinary Indian opium probably, as a rule, contains only one-fourth to one-half as much morphine as B.P. medicinal opium, it does not necessarily follow that the latter is from two to four times as strong as the former.

Fatal dose for children.—Death has been caused in an infant, five days old, by two drops of tincture; in another, nine months old, by four drops of tincture; and in a third case, one grain of Dover's powder, equal to one-tenth of a grain of opium, nearly killed a child four months old (Taylor¹). **For adults.**—In the case of these, the smallest fatal doses recorded are: two

(1) *severo catarrh*, (2) *cough*, and (3) *asthma*, died from doses equal to less than four grains of opium. In one of these cases, the fatal dose was twenty-five drops of the tincture, and in another, fifteen drops of Battley's solution. The case just mentioned excepted, the smallest fatal dose of the tincture on record appears to be two drachms. Blyth, however, points out that the tincture, as usually sold in England, varies greatly in strength. Recovery has been recorded from very large doses

¹ Poisons, p. 357.

² *Id.*, p. 535.

³ *Id.*, p. 714.

of opium. Woodman and Tidy consider that four grains of opium (presumably English medicinal) would in most cases prove a poisonous dose.¹

Fatal period.—Shortest recorded, forty-five minutes. Usual period nine to ten hours; in rare cases, two to three days. The prognosis is favourable if the patient survives twenty-four hours.

Treatment.—If the poison has been introduced into a wound, etc., remove it as far as possible and wash out the part. If it has been swallowed, wash out the stomach well by the stomach-pump; if the latter is not available, then give an emetic or inject apomorphino hypodermically. Endeavour to rouse patient and keep him roused by cold affusion, sinapisms, and flicking with a wet towel, and in severe cases the faradic current. In the less severe cases a cold douche and walking the patient about may be sufficient, but the forced perambulation should never be done where the surface of body is cold or where coma is present. For profound coma artificial respiration should be tried along with electricity. Administer hot strong infusion of coffee freely if the patient can swallow, also give a sniff of smelling salts. As a chemical antidote permanganate of potassium has been advocated by Moor² and his success confirmed by many others, Dr. Maynard having used it successfully in nineteen cases in India.³

Moor recommends 10 to 15 grains of potassium permanganate dissolved in 3 to 8 ounces of water to be repeated every half-hour for three or four times. If crude opium or the uncombined alkaloid has been taken, the solution of permanganate is to be acidulated with a little sulphuric acid. One grain of permanganate in one ounce of water he recommends should be given for each grain of morphino or every 10 grains of opium taken.⁴ Luff found that on mixing 3 grains of acetate of morphine with vomit and then treating the mixture with 4 grains of permanganate dissolved in 4 ounces of water, no morphine could be extracted from it; and he recommends that the stomach should be washed out at intervals with a weak solution of permanganate to oxidize any of the poison which may be excreted into it. The permanganate should not be used in concentrated solution, as it may corrode.

Atropino introduced hypodermically has been used as a

¹ *For. Med.*, p. 371.

² *Medical Rec.*, 1894; also *Permanganate Treatment of Opium Poisoning*. London, 1899.

³ *Brit Med Jour*, May 16, 1896.

⁴ *Id*

physiological antidote to stimulate the respiratory centres, but its utility is somewhat doubtful. One-twentieth of a grain is injected and may be repeated till pupils dilate. The following cases show that in opium-poisoning very large doses of atropine are tolerated. This, to a certain extent, supports the theory that atropine is a physiological antidote for opium.

Of the 31 who died, 7 had been under 2; 11 over 2 and under 6; 8 over 6 and under 20, and 5 over 20 hours in hospital. The amount of atropine injected in the fatal cases was, in 9 a $\frac{1}{2}$ of a grain; in 10 over $\frac{1}{2}$, but not more than $\frac{3}{4}$ of a grain, in 8 over $\frac{1}{2}$ and under $1\frac{1}{2}$ grains, and in 4 over $1\frac{1}{2}$ grains. The amount injected in the 33 cases of recovery was, in 12 $\frac{1}{2}$ of a grain, in 12 more over $\frac{1}{2}$ to $\frac{3}{4}$ of a grain; and in 9 from over $\frac{1}{2}$ to $1\frac{1}{2}$ grains.

Strychnine as well as ether hypodermically are useful.

Post mortem appearances.—Not characteristic. McLeod summarizes them as follows in well-marked cases.—“Brain turgid; lungs congested; the head distended with liquid blood, liver and spleen engorged; mucous membrane of the stomach either natural or slightly and uniformly injected”¹

Opium eating, etc.—The habit of opium eating widely prevails in India. Very generally the crude drug is used. Sometimes, however, as in Rajputana, a watery decoction, known as ‘*lusoomba*,’ or ‘*Umal*’ is employed.² Opium smoking is also much practised, a watery extract of the drug called ‘*chandul*’ being commonly used for this purpose. The question whether opium eating, smoking, etc., is or is not injurious to health has been hotly debated. There appears, however, to be a pretty general consensus of opinion among medical men who have actually practised their profession in countries where these habits

¹ *Beng Med Rept*, 1869, p. 109

² Col. Todd frequently alludes to it in his *Rajasthan*. The act of eating opium together was the form by which the rival clans became reconciled, and personal friendships were declared. “*Umal Lar Khana*”—to eat opium together—is the most inviolable pledge, and an agreement ratified by this ceremony is stronger adjuration. If a Rajput pays a visit, the first question is “*Umal Khya f*”—“Have you had your opiate?” “*Umal Khao*”—“take your opiate.” On a birthday, when all the chiefs convene to congratulate their brother on another “knot to his years,” the large cup is brought forth, and by the . . . not with . . . is fit for . . . f business . . . they become mere legs. “Opium,” he adds, “is more necessary to the Rajput than his food.”

prevail that, used in moderation, opium neither tends to injure health nor to shorten life. Abuse of opium, like abuse of alcohol, may cause derangement of digestion, and general impairment of health. Abuse of opium, however, is much less likely than abuse of alcohol to injure health, and appears to be much less common among opium eaters, smokers, etc., than abuse of alcohol is among alcohol drinkers. In persons accustomed to the use of opium, the preliminary stage of excitement, slight or absent in cases of poisoning, is a marked effect of a moderate dose. Chevers gives a case where a man, presumably an opium eater, previous to committing murder, swallowed, apparently to nerve himself for the deed, so large a quantity of opium that he died a few hours after committing the crime; see following case. For the question of criminal responsibility in such cases, see p 387, also 'Alcohol.'

On animals.—It has been found that large quantities of opium may be given by the mouth to pigeons and other birds, without narcotism being caused. Blyth remarks that the explanation of this is that the poison is not absorbed, as subcutaneous injection of morphine has been found to act rapidly on all birds hitherto experimented on. In frogs, opium excites tetanus, followed by paralysis of reflex action.

Preparations of opium.—Of the stronger B.P. and I.P. preparations, the following quantities correspond to about one grain of opium:—*Extractum opii*, $\frac{1}{2}$ to 1 grain; *pilula saponis comp.*, 6 grains, *pil. plumbi cum opio*, 8 grains; *pulvis ipecacuanha comp.* (Dover's powder), *pulvis opii comp.* and *emplastrum opii*, 10 grains; *unguentum gallic cum opio*, about 13½ grains; *tinctura opii* (laudanum), 14½ minims. *Extract opii liquid*, and *vinum opii*, are both slightly stronger than the tincture. Several patent medicines and quack nostrums also contain opium, among these may be mentioned *black drop*, an acetic acid solution of opium about four times as strong as the tincture. *Buttley's liquor opii sedativus* has about the same strength as *extractum opii liquidum*, B.P., and *Nepenthe*, a nearly colourless alcoholic solution of opium, has about the same strength as laudanum. *Godfrey's cordial*, used as a

sedative for children, contains one grain and a half of opium per fluid ounce. Other opiate preparations, used for the same purpose, are *Mrs. Winslow's Soothing-syrup* and *Dalby's Carmine*. The first contains about one grain of morphine, with other opium alkaloids, per ounce; and the second, about one-sixth of a grain of opium per ounce.

Morphine or morphia.—The symptoms, etc., in poisoning by this alkaloid, or one of its salts, are similar to those of poisoning by opium, except that convulsions are apparently oftener present. The alkaloid itself is only very sparingly soluble in water, and is not officinal. The two salts of morphine most commonly employed, both of which are officinal, B.P. and I.P., are the acetate and the hydrochlorate. Both these are much more soluble in water than morphine, the hydrochlorate being soluble in about sixteen parts of cold water, and less of boiling water, and the acetate more soluble than the hydrochlorate. The medicinal dose of either salt is one-eighth to half a grain. One grain of either may be regarded as a minimum fatal dose for an adult. The I.P. contains the following preparations of these salts:—Of the acetate, a solution, strength four grains to the fluid ounce, of the hydrochlorate, a solution of the same strength, also suppositories, half a grain in each,

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was found to contain morphine. The Burma Chemical Examiner in 1898 reported that in 51 cases analyzed morphine was detected in the substances examined, and the use of these pills had now extended throughout Lower Burma and as far as Mandalay. Those consumed in the Arakan division were usually made locally, while those used elsewhere in Burma were apparently of Chinese manufacture.

Chlorodyne contains morphine as its chief active ingredient, and some cough lozenges have proved poisonous on account of the chlorodyne used in their manufacture. According to Blyth,¹ Brown's chlorodyne contains in each fluid ounce of the mixture about seven grains of hydrochlorate of morphine, six drachms of chloroform, and 10½ drops of Scheele's prussic acid, and 53 minims of tincture of Indian hemp. In poisoning by chlorodyne the pupil has been observed to be dilated,² doubtless due, as

¹ Poisons, p. 288.

² Hughes' *Branthwaite's Retrospect*, 1899, p. 5, and A. Powell, *Ind. Med. Gaz.* 1902, p. 385. The latter observer found the pupil to be widely dilated in all of the last four fatal cases. This experience is opposed to Taylor's dictum that "usually in fatal and dangerous cases there is contraction."

suggested by Professor Powell, to the symptoms of prussic acid poisoning preceding and overshadowing those due to morphine. *Treatment*.—Should keep in view of these constituents of this mixture. In a case reported by Dr. Hughes the pupils were fixedly dilated slightly, and lips cyanosed. Ether and strychnia were given, but respirations ceased. Artificial respiration was kept up for three hours, procuring shallow breathing till death some hours after by cardiac failure.¹

Poppy capsules, *Post* (Hind.), (see Fig. 51), are narcotic. *Syrupus papaveris*, B.P. and I.P., prepared from the capsules freed from the seeds, is said to have a strength equal to about two grains of opium per fluid ounce. The B.P. and I.P. also contain an extract prepared from the same, the medicinal dose of which is two to five grains. Poppy oil, expressed from the seeds, *Kash-kash-ka tel* (Hind.), is used largely in India in food, and appears to be inert. Another oil met with in India under the name of poppy oil, unlike poppy-seed oil, is dark brown in colour, and has a strong odour of opium. It appears to be a vegetable oil which has been used for softening old opium; it is employed as an anodyne application, but I have not been able to detect either morphine or meconic acid in the specimens I have examined.

Detection.—Meconic acid in solution gives, with ferric chlorido solution, a blood-red colour, not destroyed by dilute hydrochloric acid (distinction from acetates), and not destroyed by mercuric chloride solution (distinction from sulphocyanic acid). Morphine in solution gives: (1) with strong nitric acid, an orange colour changing to yellow; (2) with a mixture of bichromate of potassium solution and strong sulphuric acid, a green colour; and (3) with a mixture of starch solution and solution of iodic acid, a blue colour. In solid form morphine sublimes at 330° F. without change of colour, it melts at 340° and darkens with deposit of carbon; whereas strychnine sublimes at 345°, melts at 430°, when it darkens from deposited carbon; tartar emetic sublimes slowly at 480°, and chars at 550°, whilst arsenious anhydride, calomel, and corrosive sublimate sublime without change of form or colour at 260°, 240°, 200° respectively.

Preparation for examination.

with alcohol acidulated with acetic acid, strain through cloth,

¹ Morphine is only very sparingly soluble in ether and chloroform.

evaporate the alcoholic tincture nearly to dryness on a water bath, add a little water and a few drops of acetic acid, and filter. To the filtrate add excess of sub-acetate of lead solution and boil, filter again; the filtrate will now contain the morphine as acetate, and the precipitate the meconic acid as meconate of lead. These are to be separately treated as follows:—(1) The precipitate is to be suspended in water, sulphuretted hydrogen passed through the liquid, the liquid filtered, evaporated to a small bulk, and tested for meconic acid; (2) The morphine filtrate, sulphuretted hydrogen is passed through this until all the lead is thrown down; the liquid is then filtered and concentrated, and morphine extracted from it as in the Stas-Otto process (see p. 535), using amylic alcohol as a solvent. As an aid to diagnosis in a case of poisoning, the ferric chloride test for meconic acid may be applied directly to a small portion of the liquid removed by the stomach - pump. Microscopically on evaporating spontaneously the morphine extract with a drop of dilute sulphuric acid on a glass slide, crystals of morphine sulphate will be obtained as in Fig 53.

Autenreith recommends the following method of carrying out the meconic test. To the watery liquid left after extraction of alkaloids by the Stas-Otto process add some calcined magnesia and boil for about three minutes. Filter, and acidulate the filtrate with dilute hydrochloric acid. On then adding a drop of ferric chloride solution a reddish-brown colour develops. If, as frequently happens, the liquid is already of a dark-brown colour, it must be diluted with water until fairly transparent before addition of the ferric chloride. Extracts of certain grains used as food in India when treated by the above method give a brown colour which sometimes is not dissimilar from that given by extracts containing opium. Indian opium (but not Turkey opium) contains a substance that gives a rose-red colour when boiled with hydrochloric acid. In carrying out the Stas-Otto

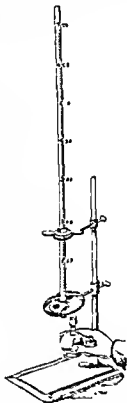


FIG 53, Sublimation—Apparatus for testing poisons (inorganic and organic) and noting the temperature at which change of form and colour and sublimation occur, showing the spirit-lamp applied to the substance placed on the disc of copper, with hollow cup in which is received the thermometer

test this substance does not pass to any great degree into the acid ether extract as does a similar pink colour producing substance formed in the growth of cholera, *B. Coli*, and other microbes. It passes into the alkaline ether extract. A few c.c. of half per cent. acetic acid are added to this ether extract. The ether is evaporated off. The residual liquid gives a pink colour when heated with a few drops of dilute hydrochloric acid. On filtering the coloured liquid the colour remains attached to the filter paper, a fact that is sometimes of use when brown colouring matters are present. This test is known as the porphyrroxin test. Occasionally different kinds of grain and flour give a pink colour when boiled with hydrochloric acid. Further research is required to decide whether, as is

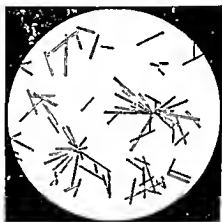


FIG 53 —Morphine Sulphate $\times 100$.
Obtained by evaporation spontaneously with dilute
sulphuric acid

probable, the pink colour-producing substance in these cases is one that passes into the acid ethereal extract.

Failure to detect, etc.—The detection of opium depends on the recognition of morphine and meconic acid, two substances which form only a fractional part of the crude drug. A very minute dose of opium, however, containing only an infinitesimal quantity of these substances, will prove fatal to a young child. In such cases analysis often fails to detect the presence of the poison. Cases also have often occurred, in which adults have died from the effects of a considerable dose of opium, and yet it has been found impossible to detect the poison after death in the viscera. Among other cases of this kind, Taylor mentions one of a young woman who died in nine hours from a dose of

one and a half ounces of laudanum, and yet, in the contents of whose stomach after death, no trace either of meconic acid or morphine could be detected. On the other hand, opium has several times been detected in the contents of the stomach of persons poisoned by it, four months or more after death. The explanation of these differences is probably something as follows. When an individual has lived for some time after swallowing the poison, especially in solution, such portion as has not been got rid of by vomiting becomes absorbed and distributed through the body, its constituents after absorption either undergoing
tributed that unlc
mitted to analysis, .

cannot be isolated. On the other hand, if the poison has been taken in the solid form, or death has been rapid, a portion of it, failing to undergo absorption before death, remains in the stomach, and, as opium has a considerable resisting power to putrefaction, its presence may still be detected even if this is far advanced. Finally, it may be pointed out, that the presence of realgar, as an adulterant in opium (see p. 476), might lead to complications of evidence in a case of opium-poisoning.

Alcohol.

Alcoholic poisoning is not very common in India except in the larger cities, as alcoholic liquors are forbidden to Mohammedans and seldom indulged in by Hindus of the better classes.

Alcohol.—Water-free or 'absolute' alcohol is seldom met with. Rectified spirit, the nearest approach to it in common use, contains 16 per cent. by weight of water. The quantity of real alcohol in liquors sold for potable use is approximately: in strong spirits, such as brandy, whisky, rum, arrack, gin, etc., 37 to 45 per cent.; in strong wines, such as port and sherry, 15 to 22 per cent.; in light wines, e.g. claret or hock, 6 to 9 per cent.; and, in malt liquors, such as porter and ale, 3 to 6½ per cent. *Proof spirit* (in terms of percentage of which the strength of alcoholic liquors is often stated) contains 49.24 per cent. by weight of absolute alcohol.

Acute alcoholic poisoning may arise from the inhalation of alcoholic vapours, as well as from swallowing alcoholic liquids. There is usually a previous stage of excitement and delirium. This is followed by stupor deepening into coma with stertorous breathing. The face is usually flushed, the breath smells of alcohol, and the pupils are generally but not always dilated. As a rule the patient can be temporarily roused into partial

sensibility by a loud noise or violent shock. Vomiting and convulsions are occasional symptoms. Occasionally also the symptoms remit, the patient recovers consciousness, but subsequently dies from failure of the respiration.

Diagnosis of alcoholic poisoning from concussion of the brain, apoplexy, and poisoning by other narcotics, e.g. opium, is sometimes a difficult matter. In these the face is usually pale, and in opium poisoning the pupils are contracted. A smell of alcohol in the breath, it must be recollected, merely indicates the presence of alcohol in the stomach; accompanying narcotic symptoms may, or may not, be due to alcohol poisoning.

Fatal dose, etc.—In terms of absolute alcohol, the probable minimum fatal dose is:—For a child under twelve, 1 to 2 ounces; for an adult, $2\frac{1}{2}$ to 5 ounces. Recovery has been recorded in an adult after swallowing a quart of whisky (probably equal to at least 9 ounces of absolute alcohol), and in a child of five after swallowing 3 ounces of rum (probably equal to 1 to $1\frac{1}{2}$ ounces absolute alcohol). In alcohol poisoning, death obviously may occur as an indirect result, as, for example, from a fall or other accident brought about by intoxication. After coma has supervened, death may occur in a few minutes or not for days. Blyth states that death has occurred after coma of three, four, or even six days' duration.

Treatment.—The contents of the stomach should be at once evacuated; should; ammoni; as in op; wise healthy subjects may be treated by large doses of digitals, but the perils of this treatment are obvious and its value doubtful.

Post mortem appearances.—The mucous membrane of the stomach generally. These vary similar to that found irritant. The brain the lungs; and the large vessels of the chest are usually found full of dark fluid blood. An odour of alcohol is usually present in the contents of the stomach, and may be noticeable also in other parts of the body.

Chronic Alcoholic poisoning.—Long continued abuse of alcoholic liquors may, as is well known, give rise to disease of various organs, and to delirium tremens. Delirium tremens

may be distinguished from intoxication by the history of the case and the character of the delirium. This may be shortly described as a delirium of dread, accompanied by delusions most commonly connected with visual perception. The patient imagines he sees various objects lying around him, or crawling about, and is often violent, with a tendency to suicide, or less commonly to homicide. As a rule he can be roused into temporary sanity when sharply spoken to. Legally, *delirium tremens* is unsoundness of mind,¹ not intoxication.

The criminal responsibility of individuals for acts done while in a state of alcoholic or other intoxication² is dealt with in ss. 85 and 86 of the *Indian Penal Code*. Section 86 is as follows:—"In cases where an act done is not an offence unless done with a particular knowledge or intent, a person who does the act in a state of intoxication shall be liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated, unless the thing which intoxicated him was administered to him without his knowledge or against his will."

Mayne, in commenting on this section, writes: "Sometimes in determining the quality of an offence, evidence is necessary of a specific existing state of mind, which must be found as a fact, and cannot be assumed. For instance, supposing a fatal blow to be struck under circumstances of grievous provocation, it might be shown that, notwithstanding the provocation, the defendant had acted, not under its influence, but from a pre-conceived malicious resolve to kill! If so, the offence would be murder. But the mere fact of the deadly blow would not be sufficient evidence for that purpose. Given the provocation, the legal inference derivable from the character of the blow would be exhausted in making the act be culpable homicide not amounting to murder. Evidence of a different state of mind would be required to constitute the graver charge. In this state of things, intoxication might be an answer to the charge of murder."

Methyl Alcohol, Wood-Spirit, Wood-Naphtha, or Pyroxylic spirit, obtained by the destructive distillation of wood, has an action on the system similar to that of ethyl alcohol. It has a peculiarly disagreeable odour, and is used for fouling rectified spirit, so as to render it non-potable. Rectified spirit, mixed

¹ For the criminal responsibility of persons of unsound mind, see 'Insanity,' p. 337.

² The responsibility is the same, no matter what the nature of the intoxicating agent is.

with ten per cent. of pyroxylic spirit, is sold under the name of 'methylated' spirit for use in arts and manufactures.

Amyl Alcohol is a constituent of *Fusel oil*, or potato spirit. —This is a higher alcohol of the same homologous series as the two alcohols mentioned above, but, unlike them, is not miscible with water. It is much less volatile than ethyl alcohol, and is found in the last portions of the distillates obtained from fermented potatoes and fermented grain. Like ethyl alcohol, it is a narcotic poison, but is much more powerful in its action, and more prone to cause convulsions. It appears to be more powerfully poisonous when inhaled in the form of vapour than when swallowed in the liquid form. Carelessly distilled whisky and other spirits are apt to contain amyl alcohol, and, in consequence, to be more powerfully intoxicant and more injurious to health. When such spirits are kept, the amyl alcohol they contain gradually decomposes, fragrant ethers being formed, and the spirit, as a consequence, improves in flavour, and becomes less hurtful.

Detection.—(a) All three alcohols are inflammable, and burn with a pale blue flame.

(b) *Formation of Iodoform*: This is best done by the process described in Remsen's "Organic Chemistry."

(c) *Sulpho-Molybdic Acid Test*—Distil viscera suspected to contain alcohol. Pour a small quantity of the first portion to distil over on to the surface of some Sulpho-Molybdic acid contained in a test tube. A blue ring forms at the junction of the two liquids. Sulpho-Molybdic acid is made by dissolving molybdic acid in concentrated sulphuric acid with the aid of heat. *The failure to give this test a proof of the absence of alcohol.* The converse is not the case, as a few other substances besides alcohol give the reaction.

(d) All three, if added to a mixture of bichromate of potash solution and strong sulphuric acid, change the colour of the mixture from red to green.

(e) Methyl and ethyl alcohols are both miscible with water. Methyl alcohol has a peculiarly disagreeable odour. Ethyl alcohol has a pleasant odour, and, when heated with sulphuric acid and an acetate, gives vapours of acetic ether, the odour of which is peculiar and characteristic. Amyl alcohol is not miscible with water, treated as above, it evolves amyl acetate, which has the characteristic odour of jargonelle pears.

From organic mixtures, methyl and ethyl alcohols may be readily separated by distillation. The liquid to be distilled, if acid, should first be neutralized. Methyl alcohol, on account of its superior volatility, should be looked for in the first

portions of the distillate. From the distillates the alcohols may be obtained, sufficiently free from water for recognition, by shaking with solid potassic carbonate. The liquid will then separate into two layers, of which the upper one contains the alcohols. Amyl alcohol, the boiling-point of which is 132°C ., will be found either in the last portions of the distillate, or in the residue in the retort. From the latter it may be removed by shaking with ether, in which it is soluble.

Ether, Sulphuric Ether, or Ethyl oxide.—This, when swallowed, produces effects similar to those produced by alcohol. It appears to be more rapid and more powerful in its action than alcohol, but its effects pass off more quickly. Blyth estimates that one fluid ounce swallowed would kill most adults. It is sometimes taken by spirit-drinkers, as a substitute for whisky, brandy, etc. Ether vapour, if inhaled, produces effects similar to those produced by inhalation of chloroform vapour, but is said to be less likely to cause arrest of the heart's action. Inhalation of ether vapour has, however, caused death. A given quantity of ether acts more powerfully when inhaled in the form of vapour than when swallowed in the liquid form.

Amyl Nitrate.—Inhalation of the vapour of this is employed for the purpose of relaxing vascular spasm. When inhaled, its first effect is to cause flushing of the face, throbbing of the carotids, a quick full pulse, and giddiness. Experiments on animals show that large doses of the vapour cause convulsions, coma, and death.

Chloroform.

Chloroform, when swallowed, produces effects very similar to those produced by alcohol, causing, if taken in sufficient quantity, coma with stertorous breathing and dilated pupils. As in alcohol poisoning, vomiting and convulsions are occasionally present. Taylor mentions a case in which an adult, who had swallowed three ounces, recovered sensibility in fourteen hours, but died of acute gastritis with collapse, twenty-nine hours after swallowing the poison. The smallest dose of liquid chloroform which has proved fatal to an adult is 35 drachms—a case of recovery, however, is reported after swallowing four ounces. One drachm proved fatal in three hours to a boy at four. A given quantity of chloroform acts very much more powerfully when inhaled in the form of vapour than when swallowed in the liquid condition. Inhalation of chloroform vapour causes (1) a stage of excitement, with flushing of

cases of poisoning, the patient should be placed in a horizontal position, and cold affusion, artificial respiration, and galvanism employed. It should be seen that nothing mechanically impedes respiration, and that the tongue is well forward. It may be necessary to draw it forward with a pair of forceps. Turning the head on one side will often suffice, and will, at the same time, allow of the escape of vomited matters, etc.

Post mortem signs.—Not characteristic. The blood is usually dark-coloured and very fluid. After death from swallowing liquid chloroform, signs of inflammation of portions of the gastric mucous membrane have been found.

Detection.—Death from chloroform may occur, and analysis fail to detect the presence of poison in the viscera, owing to its having escaped by volatilization, or its having become decomposed in the body. This last may be due to the action of the . . . med according to the . . . \therefore $\text{KCHO}_2 + 3\text{KCl}$ + . . . may be separated by distillation, and recognized in the distillate by its peculiar odour. Or the mixture, first neutralized if acid, may be distilled, and the vapours passed through a glass tube heated to redness. Under these circumstances, the chloroform is decomposed with formation of hydrochloric acid and free chlorine. The presence of the first is shown by the vapours reddening moistened blue litmus paper, and producing a white precipitate in silver nitrate solution; and of the second, by the vapours causing a blue colour to appear on paper soaked in a mixture of starch and potassium iodide solutions.

local effects of the chloroform. The mouth, the gullet, and stomach showed no signs of irritation. The blood was of a somewhat cherry-red colour, and on analysis was found to contain chloroform. The viscera on distillation also yielded traces of chloroform—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Chloral.

This is used in medicine as a hypnotic in the form of chloral hydrate, and has in several cases caused death. It causes deep sleep, followed, if an overdose has been taken, by coma with

motor paralysis, and slowing, weakening, and ultimate arrest of the heart's action, and of the movements of respiration. These effects appear to be due to the action of the drug on the nerve-centres, and not on the nerves. The pupils are nearly always contracted. A skin eruption, in some cases resembling that of scarlatina, in others urticaria or purpura, has been observed. Possibly, in many cases the fatal result is attributable to the decomposition of chloral within the body into chloroform.¹ This may be effected by the action of alkalis, a formate of the alkali being at the same time formed thus: $C_2HCl_3O + KHO = KCHO_2 + CHCl_3$. Sometimes a single overdose of chloral causes sudden death by syncope.

Fatal dose.—The probable minimum fatal dose cannot be stated with certainty. In one case thirty grains, or not more than a full medicinal dose, caused the death in thirty-five hours of a woman *æt.* twenty. Persons, however, have recovered from doses of 150 and 160 grains. The syrup of chloral B.P. contains ten grains in each fluid drachm.

Post mortem signs.—Considerable congestion of the vessels of the brain and its membranes has been observed.

Treatment.—Evacuate the contents of the stomach, preferably by the stomach-pump; administer decoction of coffee freely, introducing it by the stomach-pump if necessary; keep the patient warm, and endeavour to restore respiration. Hypodermic injection of strychnia is strongly recommended by several authorities, its efficacy is denied by others. If used, two or three drops of the solution of strychnine, B.P. or I.P., may be injected and very cautiously repeated at intervals of fifteen or twenty minutes.

chloral
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been attributed to chloral drinking.

Detection.—Organic mixtures containing chloral should be rendered alkaline by caustic potash, distilled, and the vapours tested for chloroform.

Bromal hydrate, the corresponding bromine compound, has a similar action to chloral hydrate, but is a more powerful poison.

¹ From the experiments of Hammarsten, it would appear that chloral ordinarily acts without undergoing decomposition into chloroform (see Landis Branton's *Pharmacology*, p. 715).

Cocaine.

Cocaine, an alkaloid derived from the leaves of the coca plant, *Erythroxylon coca* (the leaves of which are chewed by natives of South America to prevent the strain of fatigue being felt), is now largely used as a local anæsthetic by dentists and others.

In India, since about the year 1900, the eating of cocaine has become a habit with many persons, especially in the larger cities, where it is extensively used as a pleasing intoxicant or stimulant and aphrodisiac by natives of India, and to counteract the soporific and prostrating effect of over-indulgence in opium. It is sold now in most bazaars by the *pan* 'betel' sellers.

Action.—Locally it paralyzes the terminals of the sensory nerves, blanches mucous membranes, and dilates the pupils. Internally it first stimulates and then paralyzes the nerve centres of the brain and cord. The stimulation is of an exhilarating kind. Cocaine "fascinates by the promptness with which it relieves all sense of exhaustion, dispels gloom and exhilarates, producing a sense of happiness and well-being, which transports at once to a longed-for elysium. Through continual indulgence an intense craving for the drug or its effects is produced" (Dr. A. H. Brundage). The results of the cocaine habit are even more demoralizing and harmful than those produced by over-indulgence either in alcohol or morphine. In poisonous doses it ultimately slows the heart, reduces the blood pressure, and paralyzes respiration, raising the temperature, and convulsions may occur. In chronic poisoning patient feels as if grains of sand or worms were under the skin—this is 'Magnan's' symptom.

Fatal dose.—About two-thirds of a grain injected subcutaneously caused death of a woman aged 71 in five hours; and ten grains of the hydrochlorate swallowed by a woman caused death in 40 or 50 minutes.¹ Habituation establishes toleration of much larger doses. Some deaths have occurred through its use in order to procure local anæsthesia in dentistry.

Treatment.—If poison was swallowed, use stomach-pump. If injected hypodermically, administer stimulants, with inhalation of chloroform, or if the spasms hamper respiration, artificial respiration may be necessary.

Tests for cocaine and allied substances.—The following method is recommended by Dr. E. H. Hankin:—

¹ Dixon Mann, p. 607.

precipitates
same as
the use of

and allow it to dry. Thus a film of minute permanganate crystals is formed on the slide

on a film, place a drop of a

small trace of cocaine.

drop of alum solution up to the edge
allow the coverslip to fall, so that the

in a minute or two the
begin to form. Under
first of only drops of
alum with the formation

Crystals of this form develop instantly if the coverslip is moved. If the coverslip is not disturbed the crystals usually assume the form of branched irregular masses which show a remarkable play of colours

not
used

crystals may fail to develop. In such a case the crystals may often be caused to appear by addition of another drop of alum solution.

of

the

test It is necessary to remove it. To do so, dissolve the powder in water. Add ammonia. This precipitates the cocaine and leaves the antipyrine in solution. Filter. The residue of cocaine on the filter paper, when dissolved in alum, readily responds to the permanganate test.

Alypin gives somewhat similar crystals when tested with a perman-

Crystals formed by tropacocaine and permanganate are not pink as a rule, but red in colour. They are best formed when the tropacocaine is dissolved in water. They may take the form of curved leafy masses.

Scopolamine forms crystals with permanganate with some difficulty. They may appear when dissolved in water in the form of prisms

from lactate of

cocaine after the latter has been decomposed so as to remove the organic acid. Ammonia is added to a solution of lactate of cocaine. The solution is then shaken up with chloroform. The chloroform is separated, washed, and shaken up with a small quantity of a solution of alum. The alum takes up the free cocaine, which can then be subjected to the test.

If pieces of paper in which cocaine is supposed to have been wrapped up are received for examination, a small piece of the paper is cut off, soaked for two or three minutes in a drop of alum solution. The latter will then give the permanganate test. Or the paper may be extracted with chloroform, which will dissolve the cocaine.¹

Lett, in the *Quarterly Journal of Inebriety* for April, 1899, describes a method which he has devised which will detect this alkaloid in the urine of those who use the drug

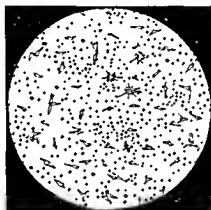


FIG. 54.—Cocaine Crystals

As obtained by Meyer's reagent under 1 objective, after Lett

Ten or twenty ounces of urine is taken, to which is added potassium or sodium carbonate until the mixture is alkaline. It is allowed to stand for half an hour and then filtered. The filtrate is agitated with two ounces of pure sulphuric ether. The ether is withdrawn, and to it is added one drachm of dilute hydrochloric acid of a strength of ten minims to the ounce. This is shaken with the ether and placed in an open dish, from which the ether evaporates spontaneously, a gentle heat being applied to obtain a perfect solution of any alkaloid on the surface or adhering to the sides of the dish. The remaining liquid may now be tested for cocaine.

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little

¹ See Hankin, "Tests for Cocaine and certain other Anæsthetics," *The Analyst*, vol. xxxvi, January, 1911

... odour of benzoic
... it can only come
... from the presence of cocaine.

The test by Myer's reagent is as follows: To a portion of the residue left from the ether evaporation add a few drops of this test reagent; a white precipitate will at once be formed if cocaine is present, which dissolves by heat, and upon cooling throws down yellow crystals, which under the microscope ($\frac{1}{n}$ objective) appear as depicted in Fig. 54. If there is an excess of the precipitate the undissolved portion will fuse into yellow gummy masses upon boiling. In following out the test with Myer's reagent, should the patient be taking quinine, it will first be necessary to precipitate this alkaloid from the solution to be tested by picric acid in excess, filter, and make the test with the filtrate thus obtained. The limit of Myer's reagent appears to be about one part of cocaine in 30,000 of water.

Cases.—The following cases are reported:—

(a) B.D., a Hindu pressman, aged 23, of Calcutta, was addicted to alcohol and to cocaine. On May 28th, 1912, he played cards with his

congested. Stomach contained about 2 ounces of recently taken food without any special odour. Cocaine was found in viscera and urine.—
Dr. C. L. Bose, *Chem Exam News* 1912

(b) K., a Hindu female

habit of taking cocaine,

a m. a few hours later.

mouth at a hydrant hard by. Very soon afterwards, she lay down, became unconscious, and in a few minutes died. Autopsy showed body

and no other poison.

(c) M.K., a Hindu female, aged 20 years, lived with her husband in Calcutta. On the 17th October, 1912, she visited her sister-in-law, Lukhi, and at about 7 p.m. on the following day, she offered Lukhi some white powder which she believed to be a specific remedy for acidity and indigestion. They each took some of the powder, and within half an hour they became ill and then unconscious. Mahan died soon after, but Lukhi regained consciousness about 4 hours later and recovered.—Autopsy showed rigor mortis present; body well nourished; pupils slightly contracted, no external marks of violence. Brain, the meninges, and the

lungs highly congested; liver, spleen, kidneys, larynx, and trachea also congested. Stomach contained food. Cocaine and no other poison present in the viscera. Death took place in this case in about half an hour.

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Several chronic cases are reported in *I.M.G.*, 1902, 85.

Coal-Tar Derivatives.

Of the countless coal-tar derivatives many are used by patients on their own responsibility to relieve headache or procure sleep, and hence poisoning is not infrequent. Antifebrin, antipyrin, phenacetin, pyrogallol, sulphonal, act as blood poisons, disintegrating the red blood-corpuscles and converting the liberated hæmoglobin into methæmoglobin.

Antifebrin or Acetanilide—Five grains in an adult have frequently produced toxic symptoms with cyanosis and reduction of temperature. It is contained in 'headache' or 'Daisy' and other proprietary powders for the relief of neuralgia, etc.

Antipyrin produces similar symptoms occasionally. **Phenacetin** has in two instances at least caused death with cyanosis. One, a girl, died in a few hours after taking fifteen grains of phenacetin, and a boy after taking a fifth dose of fifteen grains within three weeks. **Pyrogallol** or pyrogallie acid causes dyspnoea, reduction of temperature and sensibility, paralysis, cyanosis. Four fatal cases from external application for psoriasis. Treatment—Evacuation of stomach, administration of stimulants and external warmth, and inhalation of oxygen. **Naphthalene** may produce toxic effects even from external use, cyanosis and muscular twitchings. **Sulphonal** used as a hypnotic produces ataxia and death in large doses. It is cumulative. Death has occurred in a man aged 50 who took for four weeks doses of 7 to 22 grains, also in a woman aged 47 who took 15 to 22 grains almost daily till total reached over 2 ounces. The leading symptoms are staggering gait, thick speech, ataxia, paralysis of facial muscles, convulsions, coma, etc., and death from heart failure and probably uræmia. Urine is claret-coloured from hæmato-porphyrin as well as unchanged sulphonal. Treatment—Empty stomach, give purgative and large enemata of warm water and alkalis.

Veronal or Barbitone—This dangerous new soporific drug has caused several deaths in England. It is a urea-derivative,

diethyl-malonyl-urea, and occurs as a white odourless crystalline powder. It is used by the laity like sulphonal and trional, but is now placed on the list of poisons. *Toxicity and fatal dose.*—Its medicinal dose of 5 to 10 grains sometimes causes giddiness and loss of muscular co-ordination. Toxic symptoms are reported after two doses of 10 grains each (*B.M.J.*, I. 1907, 250). Death has followed a dose of 15 grains, 90 to 105 grains (*B.M.J.*, II. 1909, 1154; *Lancet*, I. 1909, 1557), 170 and 233 grains (Ehrlich, *Munch Med. Woche*, 1907). Recovery in three days after 100 grains taken with suicidal intent (Taylor, *M.J.*, II. 616).

ten

pup

legs and reddish-violet rash, or spots on the body; urine cherry-red in colour. Large doses, coma.

Treatment.—Emetics, followed by coffee, and strychnine hypodermically.

Post Mortem Appearances.—Generally those of irritant poisoning.

Detection.—Veronal is a colourless crystalline solid which melts at 182°C . The crystals, under a low power, are hexagonal prisms, and dissolve with difficulty in cold water, floating on top even on shaking, but dissolve in 12 parts of boiling water, and freely in alkaline solutions. To the solution thus obtained mercuric nitrate solution gives a white precipitate. The dry powder mixed with dry sodium carbonate and heated in a test tube, evolves ammoniacal vapours, detected in usual manner, colouring moist red litmus paper blue, and turmeric brown, when held in the mouth of the tube (H. Candy). A specific test is: A saturated solution of veronal acidified with nitric acid gives a white precipitate with Millon's Reagent, soluble in excess. A method of extraction and recognition in urine has been given in *Arch. d. Pharmacie*, 1904, 2426.—Martindale and Westcott, *Exc. Pharm.*, II., 1912, 359.

comatose, surface warm, respirations 22, pulse 102, pupils in throat.

bowels still not open, soon asleep again. During day swallowed better.

July 3, 9 A.M., condition same, ot open, croton oil one minim , not any more rousable. 8 P.M., more comatose, temp. 103.2°, pulse 130, resp. 40. July 4, 2.30 P.M., temp. 104.2°, resp. over 40, pulse 150. Died 6.30 P.M., comatose. P.M. exam.: Nothing found except intense congestion of lungs, liver, spleen, and brain, due no doubt to the asphyxial form of death. Mucous membrane of alimentary tract congested, otherwise normal.—Dr Durant, in Taylor, *M. J.*, 1910, II. 616.

Resorcin produces toxic symptoms like phenol. Nitro-glycerine.—This is a heavy, very explosive, oily liquid, almost insoluble in water, but soluble in alcohol, ether, and chloroform. Mixed with siliceous earth, it forms the explosive known as dynamite. Nitro-glycerine is a narcotic poison, acting more powerfully when inhaled in vapour than when swallowed as a liquid. In some persons, even minute doses cause violent headache. Several cases of poisoning by nitro-glycerine have occurred in Sweden, the symptoms being narcotic in character. In a case mentioned by Taylor, vomiting and purging were also present. Benzene or benzol, a liquid prepared by distillation from coal-tar naphtha, used in the arts as a solvent, is a powerful narcotic poison. Inhalation of its vapour has caused narcotic effects with twitches of the muscles and convulsions. Taylor¹ records a case of a boy who swallowed about three ounces of coal naphtha and died in three hours. The symptoms were delirium followed by coma with contracted pupils. There was complete loss of muscular power and great difficulty in breathing. Nitro-benzene, artificial oil of bitter almonds or essence of mirbane, obtained by the action of strong nitric acid on benzene, is a liquid possessing narcotic poison

in poisoning by

difference, viz. this. —

but sometimes longer, between swallowing or inhaling the poison and first appearance of the symptoms. Several deaths have been reported from swallowing nitro benzene. In one case quoted by Taylor² a boy, at thirteen, swallowed a small quantity no symptoms appeared for

Letheby,³ in which a man, at forty-three, having accidentally spilt some nitro benzene over his clothes, became comatose in four and died in nine hours. Bad effects even are said to have arisen from washing with soap scented with nitro-benzene, especially when hot water has been used.

Aniline dyes.—Aniline or Phenylamine, obtained by the action of nascent hydrogen (which may be evolved by the action of acetic acid on iron) on nitro-benzene, is a powerful narcotic poison, acting similarly to hydrocyanic acid. It is remarkable that the sulphate of aniline appears to be almost inert to man. Symptoms of poisoning, however, have followed from external application of the hydrochlorate of aniline and the use of brilliantly coloured clothing dyed by aniline.

¹ *Poisons*, p. 656.

² *Ibid.* p. 666

³ Taylor, *Poisons*, p. 666

facility in a moist and heated atmosphere. An instance was recently reported of an American girl who was poisoned by the ink used on typewriter ribbons. She stained her fingers with the ink, and thus conveyed some of the latter to a sore on her upper lip. Acute toxic symptoms subsequently quickly developed, associated with great oedema and pain locally, and a fatal result shortly afterwards ensued.

Detection of Aniline.—*Aniline* (1) with sulphuric acid and manganese dioxide, or lead peroxide, gives a green colour, changing to a persistent blue, and then to black, and (2) with solutions of hypochlorites, e.g. chloride of lime, gives a blue or violet colour, soon changing to brown. Nitro-benzene may be recognized by converting it into aniline and applying the above tests. The conversion may be effected by dissolving the nitro-benzene in alcohol, and adding hydrochloric acid and zinc. From the acid liquid, after driving off the alcohol, aniline may be separated by neutralizing the liquid with carbonate of soda, and shaking the neutralized liquid with ether. The ether is then separated, allowed to evaporate, and the residue tested for aniline. Benzene is detected by converting it first into nitro-benzene, by treatment with nitric acid, and then into aniline as above. From organic mixtures benzene and nitro-benzene may be separated by distillation. If the matters to be distilled are first acidulated with sulphuric acid, aniline, if present, will be found in the residue left in the retort, and may be separated from it by Stas' process (see p. 535), using ether as a solvent. Nitro-benzene may become changed in the body into aniline.

Carbolic acid or Phenol—Phenic acid or phenyl alcohol, obtained from coal tar, is largely used as a disinfectant and is sometimes used for suicide. It is the active ingredient of many disinfecting powders, e.g. Calvert's, which contains free carbolic acid mechanically mixed with siliceous matter, and separable from it by distillation; and Macdougall's, which contains carbolic acid in combination with lime, calcium sulphite being also present. From Macdougall's powder, carbolic acid may be separated by decomposition with dilute hydrochloric acid. Carbolic acid is a powerful poison, causing, when swallowed, burning pain in the mouth and throat, whitening and hardening of the lining membrane of the mouth, and occasionally vomiting. Insensibility speedily follows, passing into coma, with stertorous breathing and contracted pupils. The urine is suppressed or scanty, and of a dark or olive-green tint. **FATAL DOSE.**—Death has occurred in ten minutes; the usual fatal period, however, is one to four hours. One and a half teaspoonfuls of the concentrated acid has caused death, and in four cases out of five, 15 grammes (231½ grains) proved fatal to adults. Half an ounce is almost always fatal. Dangerous symptoms may be caused by six or seven drops, and death has resulted from its external application with gangrene, especially in lower extremities. *Resorcin*, a substance closely allied to carbolic acid, and like it used as an antiseptic, has a similar toxic action. **Detection.**—(1) The odour of carbolic acid is characteristic, and may be recognized during life

in the patient's breath, urine, or vomit, and after death in the tissues (2) Slips of some kinds of pine wood, moistened first with carbolic acid and then with hydrochloric acid, acquire a blue colour. The pine wood should always be tested first: (a) with hydrochloric acid only, and (b) with carbolic acid and hydrochloric acid, as some varieties give a blue colour with hydrochloric acid only, and others do not give a blue colour with carbolic acid and hydrochloric acid. (3) If to a solution of carbolic acid one-fourth of its volume of ammonia be added, and then a minute quantity of a hydrochlorate, a blue colour is produced, turning red with acids; warming hastens the development of the blue tint *Treatment*.—Alcohol is alleged to be a chemical and physiological antidote.¹ Wash out stomach with Epsom salts, and give half-ounce doses of sulphate of magnesia and sulphate of soda. The soluble sulphates combine with the carbolic acid to form harmless sulphy-carbolates. Olive oil in large doses—*eg* a couple of wine-glassfuls. The 150 grain of sulphate of atropine may be given hypodermically.

Case—Carbolic acid poisoning by absorption.—A Plaistow man on leaving his work put a quart bottle of carbolic acid in his coat with a handkerchief, which he had used to wipe his face with, and removed the bottle, which he found broken. He was taken to the hospital, and died.

Post, September 8,

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1
The nitro-solvent or "T.N.T.," a product in the manufacture of high-explosive shells in munition factories, causes by its fumes, staining and corrosion of the skin and mucous membranes, falling of hair, and sometimes even death, in spite of protective masks.

Picric or Carbazotic acid
having a bitter
mixture of
acid) obtain

Petroleum or Kerosene.—This is a mixture, occurring in nature, of hydrocarbons of the paraffin series. From it by fractional distillation are obtained various liquids. Of these

¹ A. M. Phelps in the *New York Medical Journal* of January 11, 1899, calls attention to the marked antagonism between alcohol and carbolic acid. He states that he has frequently seen Dr. Powell, at the Post Office, pour upon his hands some pure carbolic acid, and then wash them away with alcohol, and no redness or burning is observed. He frequently flushes his hands with alcohol.

the lighter are known under the names of *Petrol*, *Gasoline*, *Benzene*, *Mineral Naphtha*, and *Petroleum-ether* or spirit; the intermediate portions form the kerosene oil of commerce used for lighting purposes, and the heavier portions are used for lubricating machinery. A few cases of poisoning by petroleum are recorded, the symptoms being those of narcotic poisoning, death occasionally resulting from cardiac failure (case below). In India the majority of cases are in children under three crawling over the . . . for water. Narcotic . . . ion of the vapour. . . vomiting, followed . . . hour of the breath markedly that of kerosene. **Treatment.**—The stomach should be washed out with warm water; if in children, an ordinary soft rubber male catheter being employed instead of the ordinary tube, which is too large. Other treatment is mainly symptomatic. The child should be kept under observation for at least twelve hours, and the possibility of a sudden fatal issue never lost sight of.

Case—Kerosene oil poisoning.—Hindu male, aged 20 months, said to have drunk a quantity of kerosene oil from a lamp about two hours previously, and to have vomited ten times at home. Patient is collapsed, unconscious, pulse feeble, rapid, 160, respirations 54, abdomen distended. Stomach was washed out and washings possessed distinct odour of kerosene. Patient recovered consciousness after this procedure. Stimulants were given freely, and the general condition slightly improved, but child died suddenly next morning. Autopsy showed no lesion to account for death.—C. R. Milne, *IMG*, 1902, p. 210.

Turpentine oil or spirits.—Several slightly differing varieties of oil of turpentine exist, all being terpenes, or hydrocarbons of the formula. A few cases of poisoning of children by oil of turpentine, two of them fatal, are recorded by Taylor, the symptoms being those of narcotic poisoning. In the two fatal cases the dose was about half an ounce; the children were respectively three and five months old. Taylor also mentions a non-fatal case of poisoning in an adult by camphine, or rectified oil of turpentine, in which vomiting and purging were present. Turpentine, it may be noted, is excreted by the kidneys and communicates to the urine a smell of violets, painful micturition and hæmaturia may result from its action on the urinary organs.

Deliriant.

The majority of the more important of these are 'mydriatic deliriant' belonging to the *N.O. Solanaceæ*.

CEREBRAL POISONS.

Datura or 'Thorn-Apple.'

Datura poisoning is common in India, & facilitate theft. It is the poison used by the strangling poisoners. The seeds are usually employed in cases of poisoning by the leaves have, however, been.



with it, introduces the poison into the food without exciting suspicion.¹ Occasionally the motive of administration is other than aid to theft. It is of course possible that in some cases datura is given with homicidal intent. It rarely, however, happens that there is any ground for suspecting this, in fact, there seems to be a widespread popular belief in India that datura is simply an intoxicant, and not a poison, and certainly many of the cases do recover. Road-poisoners sometimes partake with their victims of the drugged food, which they would hardly do if aware of the danger of fatal results. Commonly, where datura is used for criminal purposes in India, the poison is mixed with sweetmeats or food, but in exceptional cases the poison seems to have been mixed with tobacco given to the victim to smoke. *Suicidal* poisoning by datura is extremely rare (see *Case*, p. 637). *Accidental* cases among children are sometimes met with. Lastly, it may be mentioned that datura is said to be used in India by vendors of native liquor, for the purpose of conferring additional intoxicating power on their wares. A method said to be followed in Bombay, is to pour the liquor into a vessel which has been first filled with the smoke of burning datura seeds.²

Symptoms.—These generally are like those of Belladonna (which see). They are in two stages, namely, delirium, and then coma. The symptoms develop rapidly: If a decoction of the seeds has been swallowed, they may appear almost imme-

is dryness of the throat, this is followed by giddiness, staggering as if intoxicated, flushing of the face, and delirium with widely dilated pupils. The dryness of the throat increases, and swallowing becomes difficult, the difficulty seeming to depend, at any rate partly, on spasm of the pharyngeal muscles. The voice becomes changed, articulation becomes indistinct, and in one case mentioned by Taylor (from *D. stramonium*) the power of speech was lost. The vision becomes indistinct or disordered. *Hypcrrpyrexia* is sometimes, perhaps often, produced. In three separate cases of poisoning by *datura* that occurred in the Hissar District in 1916³ remarkably high temperatures were recorded, viz. 105.4°, 107.4°, and 108° respectively. The first

¹ Dr. W. Carter, *Ind. Med. Gaz.* for 1874, p. 116

² The occasional presence of datura in masjun is mentioned, see '*Cannabis*,' p. 644.

³ Black, *Punjab Chem. Ex. Rept.*, 1916

case (a female) recovered, the other two (males) died. It is known that hyperpyrexia occurs in poisoning by the alkaloid *atropine*, which is chemically identical with the alkaloid *daturine*, found in *datura*, but it does not seem to be generally recognized that high temperatures may also occur in poisoning by the latter. The delirium is peculiar in character. The patient is restless; often wanders about, talks incoherently, or mutters indistinctly, but at the same time is timid and easily controlled. He goes through various ludicrous movements, appears to grasp at imaginary objects, picks at his clothes or bedding, and often appears to be trying to pull imaginary threads out of the ends of his fingers. These symptoms either gradually disappear or are succeeded by a stage of sopor with *subsultus tendinum*, deepening into coma, sometimes accompanied by convulsions, followed by gradual failure of the heart's action and respiration and death. Dr Giraud, in two out of four cases of deep coma, found a remarkable tympanic condition of the abdomen to be present. If the case tends towards recovery, the sopor passes away, and is succeeded by a stage of secondary delirium lasting about six to ten hours, and in character similar to the primary delirium of the first stage. The pupils are widely dilated throughout the illness.

Fatal dose.—This cannot be stated with certainty. Waring, however, writing of the tincture of the seeds (strength 1 to 8), considers twenty drops to be equal in effect to one grain of opium.¹ On this basis, a minimum fatal dose of the seeds would be about ten to fifteen grains, and a case is reported in which a decoction of 125 *D. stramonium* seeds, equal to about sixteen grains, caused the death of an adult in seven hours.² The leaves are less active than the seeds. One hundred seeds of *D. alba* weigh about twenty-one grains; of *D. stramonium*, about twelve and a half grains, and of *D. fastuosa*, about ten grains.

Mortality.—Dr. Giraud (in 1848) met with only one death in fifty-one cases admitted into the Jamssetjee Hospital, Bombay, and in the ten years ending 1885, of fifty-nine cases admitted into the same hospital, only two died. This, however, is an exceptionally low death-rate. Dr. Brown, of Lahore, records twenty-one deaths in ninety-two cases. In one hundred and twenty-three Bengal cases, twenty deaths were reported; and of the Bombay Analyzer's one hundred and thirty-eight cases, twenty-four died. These last three sets of figures give a total of sixty-five deaths in three hundred and fifty-two cases, or just under 18½ per cent.

¹ *Pharmacopæia of India*, p. 176.

² Taylor, *Poisons*, 774.

Post mortem signs.—These are usually wide dilatation of the pupils; congestion of the brain and its membranes, and often also of the lungs and abdominal viscera. The mucous membrane of the stomach and intestines may be found congested, and patches of extravasated blood have been met with in the large intestine. Seeds, or fragments of the seeds (see *Detection*), may be found in the contents of the stomach or intestines.

Treatment.—Administer emetics, or use the stomach-pump; and treat the symptoms, as they arise, on general principles, *e.g.* if the pulse is feeble, and the skin cold, give stimulants, if narcotism is present, use cold affusion, etc., as in opium poisoning; employ artificial respiration if necessary. Opium, or, better, morphia, hypodermically, may be given if there is much excitement. Opium, however, is less efficient as an antidote in atropine poisoning than atropine in opium poisoning. Lauder Brunton recommends the cautious administration of *physostigma*, and Ringer and others advise, in atropine or stramonium poisoning, administration of *pilocarpine nitrate* in quarter to half-grain doses.

Detection and tests.—*Datura* seeds are ear-shaped, and somewhat reniform with rounded, thickened, furrowed, wavy margins strongly compressed laterally, from one-sixth of an



FIG. 56.—Sections of *Datura* Seeds
(enlarged)

FIG. 57.—Sections of *Capsicum* Seeds
(enlarged).

inch to one-fifth of an inch broad, and about one twenty-fifth of an inch thick. *Datura alba* (Nees) of India has rather small subglobular and sharply spinous capsules, and irregular triangle yellowish-brown, roughish seeds, which are used like those of the preceding species. The seeds of *Datura stramonium* are black. *Datura metel* (Linn.), which grows in Africa and Southern Asia, has obliquely cordate, somewhat sinuate-toothed or nearly entire, soft-hairy leaves, and pendulous, spiny capsules, with brownish-yellow seeds, and, to a certain extent, resemble capsicum and tomato seeds.

Seeds suspected to be *datura*, when found in vomited

matter or in the alimentary canal, require to be carefully distinguished from the somewhat similar seeds of *capsicum* and *tomato*, both of which are extensively used as food in India. Under the microscope they present characteristic differences. Whole seeds or large fragments may readily be differentiated as follows :—

(1) *Datura* seeds are double-edged at the convex border; *capsicum* seeds are not

(2) *Capsicum* seeds have a sharp, pungent taste; *datura* seeds are feebly bitter, but not pungent.

(3) If the seeds are laid on the flat, and divided horizontally, the embryo of a *datura* seed is seen to differ in shape from that of a *capsicum* seed (see Figs 56 and 57), it is embedded in a white, oily albumen, and presents a specific curve like the head of a shepherd's crook. The exo-perm of the pulverized *datura* seed is cavernous under the microscope, whilst the *capsicum* embryo is embedded in a fleshy albumen and recurved like the figure 6 or 9, in which the curve from its point is like a commencing spiral

From organic mixtures, or the powdered seeds, the alkaloid may be separated by Stas' process, using ether as a solvent. It will be found, when dissolved in a little very dilute acid, (1) to respond to the group tests for alkaloids, and (2) when applied to the conjunctiva, to cause dilatation of the pupil. (See also *Hyoscin*, p. 640.)

There are no special chemical tests for daturine (or atropine); the physiological test (action on the pupil) is, however, extremely delicate. In man, an atropine solution of 1 to 120 commences to act in six or seven minutes, and its effect continues more or less for several days. A solution even of 1 to 48,000 will slowly cause dilatation. Herbivora, and especially the rodents, are much less sensitive than man to the action of atropine.

The following note on testing for *datura* is contributed by Dr. E. H. Hankin —

The cat is the most convenient animal
A drop of the solution to be tested
hour the animal is
If no dilatation
shine and held w
pupil to which
other

a.
b.
c.
d.
e.

f.
g.
h.
i.
j.

... proof that *datura* has been employed.

none can be detected on chemical examination. If a number of persons have been poisoned at the same time, as happens not infrequently with pilgrims, it may happen that examination of the vomit of each person separately fails to reveal the presence of datura, while if the residues of the vomits are mixed together, so that a larger amount of material is extracted, a substance having the properties of datura is detected. A further difficulty in detecting datura depends on the fact that the victims of road poisoners frequently vomit in the open air, and the asserted vomit sent in to the police is received mixed with an excessively large quantity of earth. A case is recorded from the United Provinces in which the vomit mixed with earth formed a package that was too heavy to be carried by four coolies.

Cases—Datura poisoning;

In 1899 the dead bodies of three

found at a place near Buddha

died either of heat apoplexy or c.

the *post mortem* examination on these bodies, found the brain, lungs, and liver deeply congested and suspected poisoning, but he deferred giving any opinion as to the cause of death, pending the results of

1899 (b) Two merchants started with a *sau* from Hubli in the Dharwar Collectorate, on an expedition to buy cotton in the neighbouring villages. As they were starting, a man and a woman offered themselves as guides, stating that they would show them where cotton was to be had. At a halt, food was prepared by the woman, of which the merchants and the *sau* partook, all three became insensible, and were robbed. One of the three died.—*Bo. Chem. Analyser's Rept.*, 1878-79

Cases—Datura poisoning; robbery.—(1) In 1899 a Hindu prostitute in Calcutta was visited on the night of the 10th September by two men previously unknown to her. At about midnight the men left, and the woman was afterwards found lying unconscious in the room and her house robbed. She was admitted into the Medical College Hospital

with some sweetmeats, part of which he gave her. Pearee, soon after eating the sweetmeats, began to feel ill, and suspecting that she had been drugged, went to the door and informed a chowkeedar, who kept watch

was incurable.—(3) (*Bo. Chem. Analyser's Rept.*, 1893).

Cases.—**Datura poisoning; motive other than theft.**—(1) In a case from Amraoti a man and his mother, after eating some food prepared by the wife of the former, were attacked by symptoms of datura poisoning, both recovered on the third day. The wife was arrested, and confessed to having put datura into some cooked *bhaji* (vegetables), which she had given to her husband and his mother. A portion of the *bhaji*, sent for examination, was found to contain daturine. The accused also stated that she had put arsenic and aconite root into some bread, which she had given to the two sufferers. In neither case, however, were any symptoms of arsenic or aconite poisoning present, and no trace of either of these poisons could be found in a portion of the bread submitted for examination—(2) (*Bo. Chem. Analyst's Rept.*, 1884.) In a case from Bageradi (Kaladgi District), daturine was found in some sweetmeat given by one man to another, who, after eating a portion, suffered from the usual symptoms of datura poisoning. The motive in this case was stated to be to make the victim "mad on account of left women."

Case.—**Datura poisoning, suicidal.**—The assistant-surgeon of Ghatal reported a case in which a young Hindu female took datura seeds to commit suicide, in consequence of a quarrel with her father-in-law. A quantity of datura seeds were found by the side of the deceased. The viscera were forwarded for examination, and atropine was detected in them—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Case. **Fatal trial by Datura ordeal.**—In 1899, an old Hindu woman, Radhaka Goalin, of the milkman caste, aged about 60, residing in Haro village of Monghyr district, was believed to be a witch, and her fellow-villagers deputed a professional exorcist (*ojha*) to find out whether or not this belief were true. The man gave her some prepared treacle to eat. Soon after taking this the woman developed narcotic symptoms, and died within twelve hours. The Civil Surgeon of Monghyr who made the post mortem examination forwarded the viscera of the deceased for chemical analysis. Atropine was detected in the viscera. It is common superstition in the country that witches withstand the action of poisonous drugs—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1899.

Cases with recovery—under Pilocarpine.—(1) Onkar girl, aged 3 years, was brought to hospital unconscious. Pulse breathing very feeble. The girl had eaten fresh and unripe fruits of datura, mistaking them for *sarifu* (custard apple) or *scutaphal*, which grew almost wild there. An injection of strychnine was given and the child somewhat revived. The stomach was washed out. A large quantity of chewed-up datura fruit with red-dish-brown pulp and seeds were extracted, which were afterwards dried and weighed, and the result obtained was about 3 drachms. The shock of the pumping appeared to produce collapse. Pulse could not be felt and breathing stopped. Artificial breathing was at once resorted to, and breathing restored after about half a minute. Another injection of strychnine was given, the child revived, respiration remained troubled and pulse better for some time, but again the child began to sink. A dose of brandy ($\frac{1}{2}$ drachm) was at once poured down the throat, and steady friction over the extremities used, pulse became better and breathing fair, but the child did not recover consciousness. Cold affusions were used, but without any appreciable effect. An injection of pilocarpine nitras $\frac{1}{2}$ gr. was given to counteract the effect of daturine; the result was marvellous, the child opened its eyes after a few seconds. Another injection after half an hour, and a still further improvement was at once seen. Five injections of pilocarpine nitras were given in

succession within 4 hours of $\frac{1}{2}$ gr. each; after the third injection the child was better.

(2) Girl, aged about 7 years, ate unripe fresh fruits of datura, mistaking them for custard apples. Stomach pump extracted a quantity of datura seed and pulp, weighed afterwards and found to be about half

Belladonna.

All parts of the *Atropa belladonna*, or deadly nightshade, indigenous in England, contain atropine. Cases of poisoning by belladonna are occasionally met with in England, and are usually accidental, arising either from eating the berries in ignorance of their poisonous nature, or from mistakes in dispensing or using medicinal preparations. Accidental cases of this last description have been reported in India. Symptoms are similar to those of datura poisoning, all the secretions are lessened except the urine, in several cases a scarlet rash on the skin has been observed. Recovery is frequent. In over sixty cases of belladonna and atropine poisoning tabulated by Woodman and Tidy, there were only fourteen deaths. Death has been caused by a few of the berries; and two of the berries, and three grains of the extract, have each caused bad symptoms. Death also has resulted from the application of atropine to a blistered surface.

Doses.—Ordinary medicinal doses are of atropine, $\frac{1}{100}$ th to one twenty-fifth part of a grain, of extract of belladonna, $\frac{1}{4}$ to one grain; and of the tincture (strength, one of leaves to twenty of proof spirit), 5 to 20 minims. **Post mortem** signs and treatment are the same as in poisoning by datura. **Detection.**—The flowers have a bell-shaped corolla about one inch in length, dull reddish-purple in colour, and pale green at the base. The berries are rounded, about three-quarters of an inch in diameter, purple, black, and shining. The seeds are small, about one-tenth of an inch in diameter, and studded with projections. Organic mixtures may be subjected to Stas' process.

Scopolia lurida leaves and stalks were eaten by Gorkhas in the Black Mountain campaign in mistake for a Nepalese vegetable and caused poisoning symptoms like belladonna.—A. J. Macnab, *Ind. Med. Gaz.*, 1903, p. 365

Hyoscyamus or Henbane.

Three species of hyoscyamus are found on the northern borders of India, namely, *H. niger* in the temperate Western Himalaya, *H. pusillus* in Western Tibet, and *H. muticus* or *rusanus* in the Western Panjab, Sindh and Baluchistan, dis-



FIG. 58.—Hyoscyamus Seed and Longitudinal Section.
Magnified 7 diameters.

tributed to Kabul and Asia Minor, whence the Indian name for the seeds of the latter, *Khorasani-ajwan* (Hind) or *Khorasani-owa* (Bom.) The latter species, from its deliriant and intoxicating properties, is known as *Koh-i-bhang* or mountain-hemp, from a fancied resemblance to Indian hemp; and is said to be smoked in small quantities by debauched *fakirs*, and to be used by evil-disposed persons to injure those with whom they had a quarrel. It was described as causing dryness and constriction of the throat, and furious delirium. In Sindh, writes the Commissioner, in 1894, regarding *H. muticus*, Baluchis, who use it as an intoxicant, dry the leaves and flowers and smoke the mixture exactly like *ganju*. But it is very powerful and makes them positively mad. Under its influence they strip themselves naked and dance about like lunatics. It grows wild about the Khirtar Mountains, where it flowers in March. I have ascertained that it is used in this way all along the Sindh border. Baluchis and Sindhis (and especially those of mixed Sidi and Baluch breed, calling themselves Gaddos or Khaskelis, the descendants of slaves) are addicted to hemp drugs, which are grown or manufactured in Sindh on the Munchar Lake, and the use of henbane is stimulated by the sale of the hemp drugs being a monopoly and the drugs themselves more expensive. All of these Indian species of hyoscyamus contain a poisonous alkaloid *hyoscyamine* and *hyoscyne*, resembling *atropine* in action, but weaker.¹ The leaves of *H. niger* are officinal in both Indian and British Pharmacopæias. **Dose.**—Ordinary medicinal doses are: of the extract (of the leaves) five to ten grains; and of the tincture half a drachm to a drachm. Of hyoscyne a fatal dose is a quarter to half a grain. **Symptoms**, generally like *datura*, some

¹ Dr T. E. Stocks, F.R.S., in *Hocher's Jour. Bot.*, 1852, p. 17-1.

delirium and excitement at first, followed by drowsiness, unconsciousness with complete paralysis, and in fatal cases death in a few hours. A few (not Indian) cases of poisoning by hyoscyamus have been reported. In one, a woman suffered severely, but recovered from a dose of eleven drachms of the tincture; and in another, six adults, of whom one died, were poisoned by eating the roots in mistake for parsnips. In a third, two boys, one of whom died, were poisoned by the seeds.

Treatment as in datura poisoning. **Detection.**—Dymock describes the hazaar-seed as "reniform—laterally compressed, equal in size to that of *H. niger*¹ (see Fig. 58), of a light brown or grey colour, the testa is finely reticulated. The albumen is oily. The

nine being re
and acrid."

pupil, and may be recognized, but not distinguished from atropine, by this property. It may be separated from organic mixtures by Stas' process as for atropine, and hyoscyne can be distinguished from atropine and hyoscyamine by the bromine test.

Hyoscyne Poisoning.—Crippen Case.—An American quack charged, October, 1910, with murder of his wife by hyoscyne, and brutally cutting up her body into small pieces, burying it under the floor of a house in London. Identification was made through the scar of an old abdominal operation and the identity of the pyjamas in which some of the remains were wrapped with those of the accused. Two-sevenths of a grain of hyoscyne were found by Dr. Wilcox in the viscera examined. The hyoscyne was determined to be such undoubtedly by the bromine test. Accused paid the death penalty.

Solanine.

This is a poisonous narcotic alkaloid contained in the stalks and berries of the potatoes and other plants belonging to the genus *solanum*, N.O. *Solanaceæ*². A few cases of poisoning by plants containing solanine are on record. In many of the cases there have been thirst, vomiting, and purging. Usually severe nervous symptoms are present, e.g. convulsions, delirium, and coma. Dilatation of the pupils has also been reported, but, according to Lauder Brunton, solanine is entirely without action on the pupil. The following species may be specially mentioned —

Solanum tuberosum, or Potato — A fatal case in a girl *æt.* fourteen from eating the berries of the potato is reported, and another, in which four persons, all of whom recovered, were poisoned by eating potatoes which had commenced to germinate. Mature potato tubers ordinarily contain only a trace of solanine, 0.06 per cent., but occasionally contain more and so cause poisoning. Sixty-six soldiers at Muhlth were poisoned

¹ See Report by W. Danstan in *Agricult. Ledger*, 1879, No. 3.

² About one-eighth of an inch in diameter, and weighing one hundred and twenty to the grain (Guy).

by potatoes which contained 0.38 per cent. of solanine when raw, and 0.24 when cooked, and the symptoms included severe jaundice, and in one case convulsion (*Med Press and Cir.*, 5th June, 1901). *Solanum dulcamara*, bitter-sweet or *Woody nightshade*.—This, a common hedge plant in England, is officinal in the British and Indian Pharmacopœias. A child at four is said to have died from eating only two of the berries. According to Dymock, the dried fruit is imported from Persia into Bombay, where it is known under the name of *Anabe-sahib*. *Solanum nigrum*, or garden nightshade, *Makor* (Hind.), *Kamuni*, *Ghat* (Bom.), *Manattakkah* (Tam.), *Kalmachi* (Beng.).—This, found in gardens in England, is common wild in India. Woodman and Tidy cite two cases (both in Europe) of poisoning of children by the berries; in one, two were poisoned and one died, in the other, three children, all of whom died, were poisoned. A case also recently occurred in Karachi, in which three children, one of whom died, suffered from symptoms resembling those of datura poisoning after eating food with which *Solanum nigrum* berries had been mixed.

Indian Hemp.

Indian hemp, or *Cannabis sativa*, N.O. *Urticaceæ* (see Fig. 59), when grown in India, differs so widely in medicinal properties from the same plant grown in Europe that it formerly was regarded as a distinct species, hence the old name *Cannabis Indica*. It is met with in the bazaars of India in four forms, viz. (1) *Bhang*, *siddhi*, *sabzi*, or in *pahariya atar*, the dried leaves and small stalks; (2) *Ganja*, the flowering tops; (3) *Charas*, the resin which exudes from the leaves and branches—this is often adulterated: I have found thirty to fifty per cent. of mineral matter in specimens; and (4) *Majun*, a sweetmeat prepared with hemp. In India hemp appears to be seldom, or ever, used for homicidal purposes. Fatal, accidental or suicidal, cases have, however, been reported. Cases also have been reported where the drug has, or appears to have, been used for the purpose of facilitating the commission of an offence. It is extensively used in India as an aphroditive, and with that object is a sweetmeat handed round at Nautches. Thus Chevers mentions a case which occurred at Ahmednagar, in which a woman, having first drugged with *majun* a child aged seven, afterwards murdered him for the sake of his ornaments.¹ *Charas* is used by road-poisoners at Amritsar, in order to facilitate theft.² A case also is reported by Dr. Cullen, of Hoshiangabad, in which *majun* was given to a woman and her daughter, "not with the intention of causing death, but to effect a criminal purpose." In these two females the symptoms present exactly resembled those of datura poisoning, and it would appear that

datura is sometimes used as an ingredient of *majun*.¹ In a case sent by the Bombay police in 1883, some food, alleged to contain cannabis, and to have been used for drugging persons in order to facilitate theft, was found to contain a resinous substance, which, when separated and given to a dog, caused distinct narcotic symptoms.

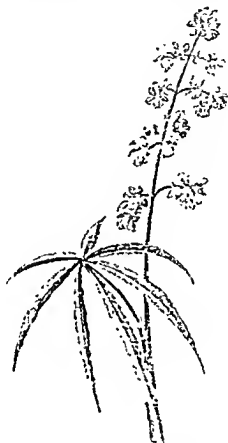


FIG. 53.—Indian Hemp *Cannabis sativa*

Symptoms.—Some persons exhibit great susceptibility to its action, fractional doses, even as medicine, producing alarming symptoms of floating up into the air.² Hemp acts on the brain, causing usually excitement, followed by narcotism.

¹ Ainslie speaks of *datura* as a usual constituent of *Majun*. Heringbarger says that it is sometimes used as an adulterant of *Majun*.

² Cf. Christison's *Dispensary*.

During the stage of excitement, the individual is the subject of hallucinations, usually, but not invariably, of the pleasurable, and often of a sexual character. In this stage the patient may show no outward indications of excitement, or he may be con-

pupils. Commonly, there is tingling and numbness of parts of, or over the whole body, or, in severe cases, general anaesthesia may be present.

Detection.—The active principle of cannabis is generally considered to be a resinous body, *cannabin*. In addition it contains a volatile oil, and from recent researches, apparently, also a volatile alkaloid in minute quantity. Authorities differ on the question of the action of these two last-mentioned substances. Warden and Waddell¹ are of opinion, however, from the results of their experiments, that both the oil and a volatile, apparently alkaloidal, substance separable by distillation from an alcoholic extract of the plant, are inert. *Cannabis cannot be identified by chemical tests.* Its recognition, therefore, in a medico-legal inquiry must depend on the physical characters of the plant, and its physiological action.

(a) *Physical character*—Dymock describes the leaves as deep green in colour, they "have long petioles and are digitate, with linear-lanceolate, sharply-serrated leaflets, tapering to a long smooth point." The same author also states, "The flowers form erect clustered spikes, often six to eight inches long; in the drug (*ganja*) the spikes are compressed, flat, glutinous, and of a brownish-green colour; they have a peculiar narcotic odour.

According to Dr. S. N. Ridley, the following characters of Indian hemp are peculiar: (1) The leaves are small, narrow, and serrated. The serrations are pointed, and the leaves are covered with hairs, including the free margin. (2) When the hemp is fresh and in good condition, each hair is seen (when examined with a lens) to be terminated by a lump which may be of a golden colour. (3) The seeds are covered by a loose husk, the outer surface of which is marbled in a characteristic way. In young the seeds are of pale fawn colour with no marbling. In good *ganja* the seeds should be grey with white marbling, mixed with a certain amount of pale young seeds. If too old the appearance is similar, but there is a larger proportion of fully mature seeds. The leaves are in this case in bad condition and

¹ *Pharmaceut. Jour.*, 1883-86.

withered. In good ganja some of the buds are still compact and unopened. If fresh and in good condition ganja has a peculiar musty smell and taste.

(b) *Physiological action*.—Portions of the drug, if available, may be administered to a dog; or food, sweetmeat, etc., supposed to contain cannabis, may be digested with alcohol, the alcoholic solution filtered and concentrated. The resin may be then precipitated by the addition of water, separated, and administered to a dog.

Use of cannabis as an intoxicant.—This is widely prevalent in India, the drug being either smoked (*ganja* smoking) or swallowed. Insanity in India is often attributed to indulgence in cannabis (see p 363). Chevers remarks that "it is a matter of popular notoriety, both in Bengal and the North-West Provinces, that persons intoxicated with *ganja* are liable to commit acts of homicidal violence. In some cases of homicide committed, or alleged to have been committed, while under the temporary influence of cannabis, one person only has been attacked. Usually, however, the victims are numerous, the case assuming the form known as *running amok* (see p. 646). Cases of *running amok*, however, have been reported in which the criminal has been under the influence of an intoxicant other than cannabis (see *Case*, p 370), and also cases in which the criminal does not appear to have been under the influence of any intoxicant. In *running amok* cases, whether while under the influence of an intoxicant or not, usually the first individuals injured are persons with whom the criminal is at enmity. Commonly, when acts of homicidal violence are committed while under the influence of an intoxicant, some motive is traceable for the crime. In some cases the motive will, on inquiry, be found to have pre-existed the intoxication; and when this is so, there often appears to be reason to suppose that the intoxicant is taken by the criminal with the object of nerveing himself for the deed. In other cases, the motive, such as it is, apparently comes into existence subsequent to the commencement of the intoxication. As already pointed out, the question of criminal responsibility for acts done while in a state of intoxication, is not affected by the nature of the intoxicating agent. Hence ss 85 and 86 of the *Indian Penal Code* apply with the same force to cannabis intoxication as they do to alcoholic intoxication. Indian hemp is sometimes administered with criminal intent in tobacco, a pipe or 'huka' of which is offered to the victim.

Cases.—Homicidal violence committed while under the influence of cannabis (Chevers, *Med. Jur.*, pp 79) et seq 1—(a) "Madar Bakh.

principle (absinthin) and a volatile oil. The latter is a narcotic poison, causing stupor, convulsions, and dilated pupils. In one case half an ounce of the oil caused very severe symptoms in a male adult. *Absinthe*, a French liqueur, contains oil of wormwood, and when taken in excess gives rise to loss of intellect, paralysis, and epileptiform convulsions, combined with the usual effects of chronic alcoholic poisoning. *Tansy*.—*Tansy*, *Tanacetum vulgare*, N.O. *Compositæ*, contains a volatile oil possessing apparently a similar action on the system to oil of wormwood. Woodman and Tidy¹ mention two cases of poisoning by Tansy, taken with the object of causing abortion. In both cases coma supervened, but in neither was miscarriage produced. One of the two terminated fatally. *Coriaria myrsinifolia*.—A few cases of poisoning by the berries

Lauraceæ. Its chemical composition is represented by the formula. Another variety, Borneo camphor, from the *Dryobalanops aromatica*, N.O. *Dipterocarpeæ*, has the composition. Camphor is administered

a dose of 160 grains, and in another case from a dose of 270 grains.

Poisonous Mushrooms.

Certain species of mushrooms are non-poisonous and are used as articles of food. Others are poisonous, and cases of accidental poisoning occasionally occur from one of the poisonous being mistaken for an edible variety. Poisonous mushrooms have the following characters:—Unlike non-poisonous mushrooms they have a bitter, astringent, acrid, or salt taste, and on section and exposure change colour, a brown, green or blue tint developing on the cut surface. The symptoms in mushroom poisoning may be those of irritant poisoning, or those of cerebral poisoning, or both sets of symptoms may be present. Prominent cerebral symptoms in mushroom poisoning are excitement and intoxication, convulsions, delirium, and stupor, with dilated, or in some cases contracted, pupils. Of the better known poisonous varieties, one, the *Amanita muscaria*,

¹ *For. Med.*, p. 451.

² Woodman and Tidy, *For. Med.*, p. 233.

³ *Poisons*, p. 162.

well as in Sind, C . . .
elsewhere in India,

The onset is in . . .
up feeling pains in the loins and calves and an inability to move his legs. The lower limbs assume the rigid character of spastic paraplegia (*lateral sclerosis*) and in severe cases may proceed to complete paraplegia. The knee-jerk is greatly exaggerated; ankle-closus is generally readily obtained and in severe cases is caused in progression when the weight of the body is brought to bear on the ball of the toes. A slight tap may throw the legs into severe clonic spasm. Initial and transitory paralysis of the bladder has been described, but was not noticed in any cases.

Beyond the initial backache, etc., there is no sensory disturbance, there is no muscular atrophy except such as arises under the famine conditions which may have forced the patient to resort to a diet of *peasari*.

The head,
not affected, s
useless for pro . . .
by means of a *lathi* grasped in the hands, or in other cases squats in a metal basin and "rows" himself about with clogs held in the hands.

Lohum temulentum, *Darnel* or *Bearded darnel*, *Mostaki* (Panj), *Mochri* (N.W.P) —A few cases of poisoning, mostly non-fatal, have occurred both in India and in Europe, due to the consumption of bread,

ing to Hassall, the starch granules of darnel are polygonal, like those of rice, but much smaller. The structure of the testa, also, in the main resembles that of rice, differing, however, in the fact that in darnel the outer coat consists of a single layer of broad cells disposed transversely, and not of narrow transverse fibres as in rice.

Paspalum scrobiculatum, *Kodra* or *Harik*.¹—Cases of poisoning are

Bombay Chemical Analyser, from Godhra, in 1879-80, four persons, viz. a man and three children, were poisoned by eating bread made from

¹ Dr. G. Watt, *Ind. Med. Gaz.*, 1895

kodra flour, and one of the children died. Kodra appears to be only occasionally poisonous, according to popular belief, in fact, it is supposed that there are two varieties of the grain, a sweet and bitter variety (*Goraharik* and *Majara harik*), of which the latter alone is poisonous. As is the case with darnel, the precise nature of the poisonous principle present in kodra is unknown. So like, however, are the symptoms of kodra to those of darnel poisoning, that it has been suggested that so-called kodra poisoning is really darnel poisoning, arising from accidental mixture of darnel with the grain.

Maize poisoning.—This condition, which has been called 'Zeism,' produced by defective maize, appears to be *Pellagra*. Certain of the poisons already described under Vegetable Irritants act also on the brain. Thus stupor or insensibility with dilated pupils has been observed in poisoning by *Tylophora fasciculata*, *Daphne mezereum*, *Laburnum*, and Yew. Cerebral symptoms also present in cases of poisoning by *Cocculus indicus* and the fruit of *Terminalia bellerica*. Lastly, it may be mentioned that cases have been met with in India (chiefly among children) which tend to show that the kernels of the fully developed seeds of star-anise, *Illicium anisæum*, possess a narcotic action.

CHAPTER XXIX.

SPINAL POISONS.

UNDER this head may be grouped a few of the neurotic poisons which act mainly on the spinal cord. This action may be stimulant in character or the reverse. If stimulants, the result may be production of muscular spasm as in strychnine poisoning; if the reverse, paralysis, or loss of sensation, results. Cerebral symptoms are, as a rule, either absent or slight, and death usually occurs by asphyxia, due to arrest of the movements of respiration. This arrest may, as in strychnine poisoning, be the result of spasm, but is more commonly due to paralysis, though calabar bean slows the action of the heart, and so may cause death by syncope.

General indications of Treatment should be: (1) Elimination, by giving emetics or using the stomach-pump; (2) prevention of action by administration of animal charcoal, or of gallic acid, or tannin or decoctions containing tannin; (3) counteraction of effects by treatment of the symptoms as they arise, *e.g.* administration of stimulants to counteract depression, employment of artificial respiration, etc. Certain drugs more or less antagonize the action of some of the poisons of this order, and are recommended for use as physiological antidotes; thus, in strychnia poisoning, inhalation of chloroform is specially indicated.

Spinal poisons may conveniently be divided into (1) those which specially affect the cord, or central poisons, and (2) those which primarily affect the peripheral extremities or trunks of the nerves, or peripheral poisons. The central spinal poisons include strychnine, calabar bean, and gelsemium; of these the first excites, and the other two paralyze, the cord.

Nux Vomica and Strychnine.

Strychnine or strychnia is one of the most deadly of known poisons. It is contained in several plants common in India

belonging to the genus *Strychnos* of the N.O. *Loganiaceæ*, together with another poisonous alkaloid of similar action, but milder in degree, named *brucine*.

iz vomica, in combination with
al with mallo acid. *Strychnos*

3. *Strychnos colubrina*, *Snake-mood*, *Naga-musadi* (Tel.), *Modira-caniram* (Mal.), *Kuchila-lata* (Hind.), *Goagari-lakri* (Rom.), *Kajarvel* (Mar.). 4. *Strychnos Tieute*, the *Upas tree* of Java and a noted arrow poison.

Strychnos toxifera belonging to the same genus is believed to be the chief source of curara (which see, p. 701). Several species of *strychnos*

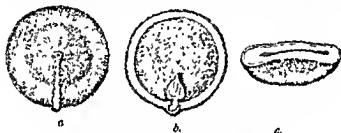


FIG 60.—*Nux Vomica*, $\frac{1}{2}$ th natural size.

- a Surface with raphe
b Longitudinal section showing albumin and embryo.
c Transverse section showing central cavity

are non-poisonous.
torum, *Nirmali* (Hind.)
which are used und
water. They are a
brownish-grey in colour, and not bitter.

In India, poisoning by *nux vomica* is occasionally met with, the cases being generally suicidal or accidental.

Among the causes leading to accidental poisoning may be mentioned, (a) The practice of *nux vomica* eating, which to a certain extent prevails in some parts of India; and (b) The substitution of *nux vomica* or *kuchila* bark for other barks, notably for *kurchi* or *holarrhena antidysenterica* bark, a drug in common medicinal use in India as a tonic and antiperistaltic for children, and as an astringent in dysentery. In a case which occurred in Calcutta in 1882, the death of a child was traced to this substitution, and in a subsequent case, on a vendor's stock of *holarrhena* bark being seized, about one-fourth of it was found to consist of *nux vomica* bark. Waddell suggests that

this substitution may partly account for the great mortality among infants and children, yearly reported from tetanus in Calcutta.¹

Poisoning by the alkaloid Strychnine, formerly rare in India, has of late years become more frequent, owing to the greater ease with which the alkaloid can be obtained. It is usually accidental in the Bombay Presidency; strychnine powders have of late years been largely supplied to the police for the purpose of destroying dogs; and several cases of poisoning of human beings by strychnine have been reported, in which the poison was obtained from this source. Accidental poisoning has occurred through prescribing *Liquor Strychnine* along with its incompatible *Liquor Arsenicalis*, when the alkaloid is thrown down forming a poisonous dose at the bottom of the bottle. It may also occur from the deposit in the last few doses in bottles of Easton's Syrup.

Action, symptoms, etc.—Strychnine acts as a direct stimulant to the spinal cord, causing tetanic spasms, and death either from asphyxia, due to spasm of the muscles of respiration, or from collapse, occurring in the interval between the spasms. When swallowed (except when taken in the form of a pill) the first thing noticed is an intense bitter taste and dryness of tongue, this is frequently but not invariably succeeded by a feeling of suffocation and want of air. Twitchings and cramps follow, rapidly developing into intensely painful tetanic spasms, affecting nearly all the muscles of the body. During the spasms, the body frequently becomes rigid, and arched so as to rest only on the head and the heels (*opisthotonos*). During the fits of spasm also, the pupils are usually dilated, and the features drawn into a grin (*risus sardonius*). The fits of tetanic spasm alternate with intervals of muscular relaxation, the relaxation being, as a rule, complete. As the case progresses towards a fatal termination, the intervals between the spasms become shorter and shorter in duration. The convulsions may be so severe as to stimulate bruises, see *Case (d)*, below. There is no narcotism, but insensibility from exhaustion may occur before death.

¹ *Ind. Med. Gaz.*, March, 1855

after death, contained the same poison.

Fatal period, etc.—In poisoning by strychnine, the symptoms usually appear in five to twenty minutes; in poisoning by nux vomica the appearance of the symptoms is less rapid, and in one fatal case their appearance was delayed for two hours¹. Death may occur in ten minutes or be delayed for five or six hours. Of thirty-five cases collected by Woodman and Tidy,² nineteen died in an hour or less, and eleven more in one to three and a half hours.

Diagnosis from disease.—The chief points of distinction between strychnine poisoning and tetanus, the only disease likely to be mistaken for it (though epilepsy might be confused with it also), are:

(1) In poisoning the symptoms come on suddenly, rapidly become severe, and soon end in either death or recovery; in tetanus, as a rule, the reverse is the case. Chevers, however, mentions an exceptional case of sudden accession of tetanus, and death in the first spasm (see *Case* below). (2) In tetanus, the muscles of the lower jaw are early affected, stiffness of the lower jaw being often the first prominent symptom; in poisoning, the muscles of the lower jaw are the last to be affected. (3) In poisoning, as a rule, the muscles during the intervals are completely relaxed: this is not so in tetanus. The possibility of mistaking the injuries contracted during the violent spasms for homicidal bruises should be considered.

¹ Taylor's Manual, p. 172.

² For. Med., p. 330.

Treatment.—Administer emetics or use the stomach-pump, chloroforming the patient so as to allow of the introduction of the tube. Give animal charcoal or infusions containing tannin. Administer chloral, or still better, keep the patient under the influence of chloroform.

Post mortem signs.—Not characteristic, as a rule, the body is relaxed at death, sometimes, however, it remains rigid, the rigidity continuing for a very long period. The brain, spinal cord, and lungs are usually found congested; the heart may be empty or full. The convulsions may have been so severe as to bruise the body.

DOSES.

strychnine, and two cases are on record in which respectively one-twelfth and one-sixth of a grain caused alarming symptoms. In both these cases the subjects were adult females. The smallest quantities which have caused death are one-sixteenth of a grain in a child two to three years old, and half a grain of the sulphate in an adult.² Recovery has been recorded from doses of ten to twenty, and even forty grains of the alkaloid.³ (b) *Nux vomica*.—*Nux vomica* seeds contain about a quarter to half per cent of strychnine, and *St. Ignatius'* beans about one and a half per cent.⁴ The medicinal dose of powdered *nux vomica* seeds is two to three grains. In one case thirty grains of powdered *nux vomica* seeds (equal to about one full-sized seed), taken in two doses of fifteen grains each, caused the death of a girl aged ten; and in each of two cases death was caused by fifty grains.⁵ It should be noted that, owing to the insolubility of the testa, whole *nux vomica* seeds may be swallowed, and pass through the body, without giving rise to symptoms of poisoning.

¹ *Poisons*, p. 713.

² Case of Dr. Warner, *ib.*, p. 712.

³ Woodman and Tidy, *For. Med.*, p. 330.

⁴ *Pharmacographia*, pp. 430, 433.

⁵ Taylor, *Poisons*, p. 635.

Influence of habit.—Many authorities state that in different parts of India *nux vomica* is habitually eaten (like arsenic) as a stimulant and aphrodisiac. Baker, quoted by Chevers,¹ states that those who practise this habit, begin with one-eighth of a gram of the seed, gradually increasing the dose to about twenty grains. If this is so, the inference of course is, that habit tends to confer on the system a resisting power to the action of strychnine. It is, however, undoubtedly the case that small doses of strychnine repeated at short intervals tend to exert a cumulative effect. Lauder Brunton, in fact, states that strychnine is a cumulative poison, and points out that this effect is due to the slowness with which it is excreted, one effect produced by it being to contract the renal vessels, and thus interfere with its own elimination.

Unusual cases.—Harley² records a case where an infant at the breast suffered from symptoms of strychnine poisoning, the result of the medicinal administration of strychnine to the mother, who remained unaffected. Dr. Chatterjee³ met with a non-fatal case, resulting from the introduction, by a quack, of a pulp made from *nux vomica* seeds into a wound. Blyth⁴ mentions a case of attempted suicide by a young woman, who took about one and a half grains of strychnine, and two ounces of laudanum. Severe symptoms of narcotic poisoning followed, but no symptoms of strychnine poisoning showed themselves until eight hours afterwards.

Preparations : (1) Official.—The following preparations of *nux vomica* are contained in the I.P. :—

	Strength	Medicinal dose
Infusion ..	1 to 48	$\frac{1}{2}$ oz. to 1 oz.
Tincture ..	2 ozs. to 1 pint	5 to 20 drops.
Extract ..	1½ oz. equals about 1 lb. of the seeds	$\frac{1}{4}$ of a grain to 2 grains.

The I.P. also contains a solution of strychnine; strength four 1 to 109. (2) Non-official.—
 . . . in England contain strychnine.
 . . . —Miller's rat powder, a mixture of one ounce of *nux vomica* to one pound of oatmeal; Battle's vermin-killer, a mixture of strychnine with flour and Prussian blue, containing about 7·7 per cent. of strychnine; and Butler's vermin-killer, a mixture of strychnine with flour and root, or

¹ *Med. Jur.*, p. 211.

² Woodman and Tidy, *For. Med.*, p. 324.

³ *Ind. Med. Gaz.*, 1872, p. 231.

⁴ *Poisons*, p. 313.

sometimes Prussian blue, containing from about $3\frac{1}{2}$ to 5 per cent. of strychnine.

Identification.—*Nux vomica* seeds (see Fig. 60) are contained in a smooth orange-coloured berry about 2 inches in diameter, and containing about five seeds or 'nuts.' The seeds are in shape nearly circular discs, slightly concave on one side, and convex on the other, about one inch in diameter, by about a quarter of an inch thick. In colour they are light greyish, and have on the surface a silky appearance, due to their being thickly covered with short hairs. In the centre of the concave side is the *hilum* connected by a slightly elevated *raphe* with the *chalaza*, which forms a small protuberance on the edge in the neighbourhood of the radicle (see Fig. 60). They are very tough and horny, and have an intensely bitter taste. St. Ignatius' beans are about one and one-fifth of an inch in length, ovoid, but presenting three to five flattened surfaces due to mutual pressure. "In the fresh state they are covered with silvery adpressed hairs, portions of a shaggy brown epidermis are here and there perceptible on those found in commerce, but in the majority the seeds show the dull grey granular surface of the albumen itself"¹ *Nux vomica* bark occurs in quilled twisted pieces, an inch or less in diameter, thin, light brown in colour, and marked on the outer surface by numerous small light-coloured elliptic corky warts. Its inner surface is turned red by citric acid,² this distinguishes it both from *angostura* or *cuspara* bark, and from *holarrhena antidysenteria* bark; the latter also is much thicker, and is marked on the external surface by scars of exfoliation.

Detection.—Strychnine occurs in commerce as a white powder, or in white rectangular prismatic crystals, but may be obtained in other crystalline forms, e.g. hexagonal prisms, octahedra, or forms derived from the octahedron. It is freely soluble in chloroform (1 to 7 or 8), less soluble in alcohol (about 1 to 100), and still less soluble in ether. It is only very sparingly soluble in pure water (about 1 to 7000 of cold water), but readily dissolves in dilute acids. Its solution in faintly acidulated water has an intensely bitter taste, and is precipitated by the alkaloidal group reagents. It sublimes at 169° F., and condenses in minute needles. The special tests for strychnine are:

1 Bitter taste. 2. The colour test.—This depends on the fact that a play of colours, namely, blue, rapidly changes to

¹ *Pharmacographia*, p. 353.

² Owing to the presence of brucine (see p. 659)

violet, and then slowly to purple, and lastly, to red, is produced when strychnine is subjected to the action of nascent oxygen. To apply the test, stir a minute quantity of strychnine with a drop or two of strong sulphuric acid; the strychnine dissolves if pure without change of colour. Then cautiously add a minute quantity of manganese dioxide, or lead dioxide, when the play of colours appears. Potassium permanganate, or potassium dichromate, may be used instead of manganese or lead dioxide, but are not so suitable; or the test as proposed by Letheby may be conducted galvanically. In this modification, the strychnine, dissolved in a drop or two of strong sulphuric acid, is placed on a piece of platinum foil connected with the positive pole of a galvanic battery; on touching the liquid with



FIG. 61.—Strychnine crystals $\times 120$.
Obtained from an alcoholic solution

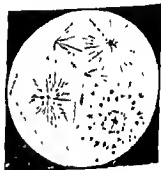


FIG. 62.—Strychnine + potash or ammonia $\times 30$

the negative pole, the play of colours appears. It has been objected that various substances, *e.g.* pyroxanthin, piperine, salicine, bile, etc., become coloured when treated with strong sulphuric acid. W appears directly the colour appears until

or other oxygen-yielding substance. Aniline salts, Woodman and Tidy point out, are not coloured by sulphuric acid only, but give a play of colours when manganese or lead dioxide is added; with aniline salts, however, the colours are first "green, then a very persistent blue, then black." 3. The physiological test.—This consists in administering, preferably by subcutaneous injection, a little of the suspected alkaloid to a small animal, *e.g.* a frog, and observing whether or no tetanic symptoms are produced. Substances other than strychnine induce tetanic symptoms; the physiological test is only useful as a negative test, to prove the absence of strychnine, or as a confirmatory test. If, however, definite chemical

evidence of the presence of strychnine has been obtained, the physiological test is quite unnecessary.¹

Brucine.—This alkaloid also has an intensely bitter taste. Its physiological action is the same as that of strychnine, but seven to ten times weaker. It is less soluble in ether, but more soluble in water, alcohol, and chloroform, than strychnine. Unlike strychnine, it gives no play of colours with nascent oxygen. The special colour test for brucine, a test to which strychnine does not respond, is as follows: Add a little strong nitric acid; a bright red colour is produced, which, on warming, becomes yellow. If, after warming, a trace of stannous chloride be added, the yellow changes to purple, destroyed by excess of stannous chloride or of nitric acid.

From organic mixtures, strychnine and brucine may be separated by Stas' process, using chloroform, or a mixture of ether and chloroform, as a solvent. If both are present, the alkaloidal residue will respond both to the nitric acid test both, in a case
 . plant contain-
 -ployed

Failure to detect strychnine.—Strychnine is an extremely stable substance, not likely to be destroyed by putrefaction. Richter² found it in putrid tissues after eleven years' exposure to decomposition in open vessels. Elimination also of strychnine from the body is comparatively slow. Hence, given that the analysis has been properly conducted, and that a sufficient quantity of material has been submitted to analysis, failure to

if death has occurred from a minimum dose of strychnine, and the patient has lived for some time after its administration, complete elimination of the poison may take place before death

Stimulation of the spinal cord is caused also by Thebaine, one of the opium alkaloids; this, however, is less active even than brucine. It is also caused, according to Lauder Brunton, by Calaharine, one of the alkaloids of Calabar bean. Spasms, more or less tetanic in character, pointing to a stimulant action of the cord, have been observed in poisoning by *Nerium odorum*. Stimulation of the spinal cord resulting in the production of epileptiform convulsions, is one of the effects of Picrotoxin, the active principle of *Cocculus indicus*; and Blyth mentions as

¹ Blyth, *Poisons*, p. 323.

Ibid., p. 321.

similar in its action to picrotoxin, the poison of *Illicium religiosum*, a plant growing in Japan. Venous blood, it may be here noted, irritates the nerve-centres; hence in narcotic poisoning, and poisoning by drugs tending to cause death by asphyxia, convulsions may precede death, even when the poison itself has no irritant action on the nerve-centres.

Calabar bean.—The seeds of *Physostigma venosum*, N.O. *Leguminosæ*, a native of Western Africa, *Physostigmatis semina*, Calabar beans, are highly poisonous. A dose of twelve grains of the seeds taken for purposes of experiment, caused alarming symptoms in an adult. In 1864, a number of children were accidentally poisoned at Liverpool by eating the beans; one who had eaten six beans died; and two who had eaten the broken fragments of the kernel of one bean, suffered severely, but recovered. Calabar bean **paralyzes the spinal cord**, slows the action of the heart, and causes death by paralysis of respiration. In experiments on animals, large doses have been found to at once arrest the heart's action, and cause death by syncope. In poisoning by Calabar bean, the prominent symptoms are gastric irritation, slight tremors followed by great weakness of the muscles, and slowness of the pulse and of respiration. The mental faculties are unaffected. The pupils are contracted, but the poison appears to act more powerfully on the pupils when locally applied than when swallowed. Three alkaloids are described as present in Calabar bean, viz. physostigmine, eserine, and calabarine. Of these, the first two are considered by many to be identical with one another, and are apparently the constituents to which the paralyzing action of the poison is due. Calabarine, according to Lauder Brunton, causes convulsions like strychnine. **Treatment.**—General, as for spinal poisons (p. 651). Both atropia and chloral, to a certain extent, antagonize the action of Calabar bean, and have been recommended as physiological antidotes. The antagonism is in neither case complete, but appears to be greater in extent with chloral than with atropia. **Identification.**—The beans are kidney-shaped, chocolate coloured externally; and have a broad black furrow, with raised edges lighter in colour than the rest of the surface, running along the convex border. Dimensions about 1 to 1½ by ½ by ⅓ an inch; weight about sixty-seven grains. Physostigmine may be extracted from organic mixtures by Stas' process, using benzene as the solvent, and identified by its action on the pupil, and by the red colour given by its sulphate with bromine water.

Gelsemium.—*Gelsemium nitidum* (syn. *G. semperverum*), or *Julia* or *jasmine*, N.O. *Loganiaceæ*. The dried rhizome and rootlets of the

10 drug

Unhke

Its active properties appear to be due to the alkaloid *gelsemine*. Worinley estimates that not more than one-sixth of a grain of gelsemine was contained in a dose of the drug which proved fatal to an adult female. Five fatal cases of poisoning by gelsemine have been reported.² The prominent symptoms are muscular weakness, followed by giddiness, frontal headache, double vision, and squinting. The weakness deepens into paralysis, the eyelids drop, vision becomes indistinct, and the muscular power of speech is lost. Respiration becomes slow, and the surface cold. The mind remains unaffected. The pupil is usually contracted, but Ringer points out that gelsemine, when locally applied, causes dilatation of the pupil, or a reverse effect to that produced by internal administration of the drug. **Detection.**—Gelsemine may be extracted from organic mixtures by Stas' process, using chloroform as the solvent. The colour tests for it are, (1) with sulphuric acid and manganese dioxide it gives a damask-red colour, changing to a rich green, most marked at the edges, and (2) nitric acid strikes with it a brownish-green, quickly changing to deep green.

Paralysis of the cord is also the special action of methylconia, a liquid volatile alkaloid allied to conia (see 'Conium'); and *ulexine*, a powerfully poisonous alkaloid contained in gorse (*Ulex europæa*), it said to paralyze the motor tract of the cord, and the trunks of the motor nerves.

¹ According to the B P (1885), the medicinal dose of the dried root is five to thirty grains, and of the tincture—strength one to eight—five to twenty minims.

² Wharton and Stille (1894), Vol III, p 416

CHAPTER XXX.

CEREBRO-SPINAL POISONS, CARDIAC, ETC.

Cardiac Poisons.

Of the poisons which act more or less directly on the heart, through a direct action on its nervo-supply, Tobacco and Lobelia are spinal as well as cardiac poisons, and cause death by asphyxia due to paralysis of the respiration, whilst Digitalis and Oleander appear to act directly on the cardiac muscle, thus tending to arrest the heart's action and cause death by syncope. Like spinal poisons, cardiac poisons leave no characteristic *post mortem* appearances.

General treatment indicated in cardiac poisoning is to try to secure: (1) Elimination, by emetics or the stomach-pump; (2) prevention of action, by giving decoctions containing tannin; (3) counteraction of effects, by the administration of stimulants, and the employment of physiological antidotal measures, such as keeping the patient in a recumbent position, keeping the surface warm, employing galvanism, and, if required, artificial respiration.

Tobacco.

Nicotiana tabacum, Tobacco
(Hind., Beng., and Bom.), *Page*
of this plant are official B.P.
tobacco used for smoking, etc.
volatile alkaloid, *nicotia* or *nicotina*,
volatile crystalline substance, *nicotianin*, or tobacco campher.
Cases of poisoning by *nicotino* are rare; one celebrated case is, however, on record, namely, the case of Count Bocarmé, convicted of poisoning his wife's brother, by forcible administration of *nicotine*. Cases of poisoning by tobacco, mostly accidental, are more common. Death has resulted from swallowing tobacco, from administration of a decoction of tobacco as an enema, and from swallowing tobacco juice such as collected in

pipes; and bad symptoms have been caused by the application of tobacco leaves to a wound, and even to the sound skin. Death has occurred from excessive smoking; it is doubtful, however, whether tobacco smoke contains nicotine; probably its poisonous effects are due to pyridene bases, developed during the combustion of the tobacco.

Action, symptoms, etc.—Tobacco first slows and afterwards quickens the pulse, acting on the heart through the vagus, which it first stimulates, and afterwards paralyzes. It is also a spinal poison, and causes death by paralyzing the respiration. The prominent symptoms of tobacco-poisoning are giddiness, muscular weakness, faintness, and depression, abdominal pain, vomiting, sometimes purging, difficult respiration, and convulsions. The pulse is at first slowed, afterwards it becomes quick, weak, and irregular. Death usually occurs rapidly. In one case fatal results followed the administration, as an enema, of a decoction of half a drachm of the leaves. **Treatment.**—Evacuate the contents of the stomach, give tannic acid and stimulants, keep the patient in a recumbent posture, and apply warmth to the surface. Blyth recommends cautious hypodermic injection of strychnia. *Post mortem* signs.—Not characteristic; there may be congestion of the brain, lungs, and liver. In some cases inflammation of the stomach and intestines has been found. **Detection.**—Portions of tobacco leaf may be found and recognized by their odour and physical characters. Nicotine may be extracted from organic mixtures by Stas' process as for conium, and recognized by its odour and action on animals. There are no special colour tests for nicotine. Nicotine does not coagulate albumen, and gives a crystalline precipitate with mercuric chloride solution (a distinction from conia).

Lobelia Indian.—*Lobelia nicotianifolia*, vern. *Deonal*, *Bohenal*, *Dhatol*.—This lobelia, Dymock states, is found upon the mountain ranges of Ceylon and Southern and Western India. The upper portion of the stem is hollow, and is dried and used as a shepherd's pipe. The plant has recently been examined, and found to contain the same active constituents as *L. inflata*. Dymock gives the following description of the plant: "The leaves resemble those of the tobacco, they are finely serrated and covered with simple hairs. The lower part of the stem is woody, an inch and a half or more in diameter, and almost solid, the upper portion is a hollow tube ending in a crowded head of flower spikes, the the plant is in fruit, are size of a pea, to which a he capsules are two-celled, seeds are numerous and very flattened and marked with numerous points. At the base of each capsule is a small point, and the site of the placental attachment, their colour is light brown. The whole plant when dry is

studded with small spots of resinous exudation, and is hot and acrid to the taste. **Action, symptoms, etc.**—Similar to those of poisoning by tobacco, except that there is more burning pain in the stomach, etc. As in poisoning by tobacco, death occurs by paralysis of the respiration. Ten to fifteen grains of the powdered leaves or seeds will act as a strong emetic, and a drachm of the powdered leaves has caused death. **Treatment** should be the same as in poisoning by tobacco. **Post mortem signs.**—Inflammation of the stomach and intestines, and congestion of the vessels of the brain.

Digitalis.

Purple Foxglove, or *Digitalis purpurea*, N.O. *Scrophulariaceae* (see Fig 63). This plant, although a native of Europe, is grown in India,



FIG 63 —*Digitalis purpurea*.

where its active principle is found to be of equal strength to that contained in European specimens (Hooper, *L.M.G.*, 1913, 181); all parts of it are poisonous. The leaves, probably the most poisonous portion of the plant, are official B.P. and I.P. Several active principles have been described as present in digitalis, of which the most important are

digitoxin, *digitalin* (a glucoside) and *digitalin*.¹ Of these, the last is the only one soluble to any extent in water. All three are powerful heart poisons. They stimulate the cardiac muscle and prolong the contractions of the heart, subsequently rendering the heart's action irregular, and finally arresting it. Of the three, *digitoxin* is said to be five to ten times more powerful than either of the others. Blyth estimates that one-sixteenth of a grain of *digitoxin* would probably prove fatal to an adult. When boiled with dilute acids, *digitoxin* yields *toxiresin* and *digitalin* yields *digitaliresin*; both these are also highly poisonous, but cause convulsions like *picrotoxin*.

Commercial digitaline.—Formerly the active principle of *digitalis* was stated to be *digitaline*. This was official in the B.P. of 1867, but has been omitted from the B.P. of 1885. *Digitaline* is still official I.P. Several being:—
chief cor-
talin as
B.P.; and (3) Soluble *digitaline*, a large proportion of which consists of *digitalin*.

Poisoning by digitalis is rare, and is chiefly due to accidents in the medicinal use of the drug. One celebrated homicidal case is, however, on record, viz the case of Dr de la Pommerais, a homœopathic practitioner, who was tried and convicted in Paris in 1864, of poisoning a woman named Pauw. The case was an assurance murder. Symptoms—

death occurs. Other symptoms of *digitalis* poisoning are dilatation of the pupils, disturbances of vision, slowing of the respiration, and suppression of urine. Salivation is often present, and convulsions are occasionally seen. Usually the mind remains clear to the last. Sometimes the administration of a series of medicinal doses of *digitalis*, is followed by a sudden outbreak of symptoms of poisoning. *Digitalis*, therefore, is generally stated to be a cumulative poison. **Preparations and Dose.**—Ordinary medicinal doses of the various preparations of *digitalis* are—of official *digitaline*, one-sixtieth to one-thirtieth of a grain, of the

of the leaves, four and a half grains, of the tincture, forty-five minims, and of the infusion, one ounce, or about three times these quantities in twenty-four hours. The same authority considers that double these maximum safe doses would be likely to prove dangerous. A case, however, is recorded of recovery after taking one drachm of the powdered leaves, and another of recovery after swallowing two ounces of the tincture. Fatal period.—Rarely less than twenty-two hours. In one

¹ Another principle present in *digitalis*, viz *digitoxin*, is readily soluble in water, and appears to have an action like that of *saponin*. This action is to a certain extent antagonistic to that of *digitoxin*, *digitalin*, and *digitalin*, its tendency being apparently to depress instead of stimulate the heart's muscle.

White or Pink Oleander.

This sweet-scented Oleander¹ is the *Nerium odorum*, N.O. *Apocynaceae*, vernacularly known as *Kaner* (Hind.), *Siceth karab*

FIG. 64.—*Nerium Odorum*, 1

(Beng.), *Marí* (Tam.), see Fig. 61. The shrub grows wild over the greater part of India, and is cultivated in gardens for its

¹ The goat feeds on the foliage with impunity, but Dr. Watt (*Econom. Bot.*) states that it is fatal to camels and other animals and poisonous also to man. The C. I. plant, is destroyed

graceful flowers. All parts of the plants are poisonous, but cases of poisoning by it are not very often reported. It is also called the 'true oleander' in contradistinction to the 'bastard oleander,' *Thecetia nerifolia* or *Cerbera thecetia* (see p. 671).

During the fifteen years ending 1888, fourteen cases of *Nerium* poisoning were referred to the Chemical Examiner, Bombay, and eleven to the Chemical Examiner, Madras, only two cases were dealt with by the Chemical Examiner, Bengal, during the same period. Of seventeen cases, nine were suicidal, two homicidal, two criminal abortions, and in four the poison was given medicinally.

For suicidal purposes the root is especially used by women in Western and Southern India and in the outer Himalayas; whilst in Bengal the fruit of the yellow oleander (see p. 672) is more often used in this way.

For homicidal purposes it is less frequently employed; but the root is commonly used for procuring criminal abortion both locally and internally. The use of the root medicinally by ignorant persons for venereal disease has occasionally led to fatal poisoning.

The active principles of the plant have been investigated by Dr. Chuni Lal Bose,¹ who discovered that the plant contains, in addition to the *Neriodorin* and *Neriodorcin* of Greenish,² another actively toxic principle, which he has named *Karabin* after the vernacular name of the plant. Like *Neriodorin*,³ it is a powerful cardiac poison, acting on the heart in a somewhat similar manner to digitalin, and it also acts on the spinal cord somewhat like strychnia.

Symptoms.—Vomiting and frothy salivation usually occurs, followed by restlessness. Pulse becomes slow and weak, respirations hurried, muscular twitchings, especially of upper extremities, deepening into tetanic spasms, which (unlike strychnia poisoning) affect one side more than another (thus, see Cases 1 and 2 below, the muscles of the right arm were chiefly affected in one case, and in another the left side). Lockjaw is frequently present. Drowsiness passing into insensibility and collapse. Diarrhoea is usually absent.

Cases.—*White oleander poisoning*.—*Accidental*.—*Multiple*. In 1898 two men were admitted into the Medical College Hospital, Calcutta, three hours after taking a cupful of a decoction of the root of *Nerium odorum*, which they had taken medicinally as an anodyne.

1. Mohammedan male, aged about 50. Vomited several times before and after coming to the hospital. Vomited matter consisted of yellowish, frothy fluid. At the time of admission he was quite conscious, and able

¹ *Ind. Med. Gaz.*, Aug. and Nov., 1901.

² *Pharm. Journ.*, 1881, p. 873.

³ The third principle *Neriacetin* is shown by Dr. C. L. Bose to be a sapogenin, with little toxic properties, so may be disregarded.

a
 b
 speak, although he appeared to understand when the patient was unable to
 smiled vacantly. The patient was unable to
 about 50 per minu
 convulsions of all
 minutes

The patient died about
 24 hours after the onset of the disease.

Image on front wall and towards apex on both walls. Liver, spleen, and
 kidneys congested. Stomach contents about 12 oz. of a thick yellow
 fluid and mucus.

years of age. The symptoms in this
 case, excepting that they were appar-
 ently more severe than those of

ing a general weakness and drowsiness in a cat, but not twitch-
 ing or convulsions. The temperature was 100.4° F.

... on young roots the corky layer is very thin
 ... yellow colour of bark is seen through it, inner
 ... The bark when cut or wounded exudes a pale
 ... which is resinous and very sticky. Odour some-
 ... like that of a raw potato. Taste acrid and bitter.
 ... The following tests are prescribed by Dr. C. L. Bese
 ... separation and identification of *Karabin* and *Neriodorin*
 ... poisoning by this plant.
 ... Separation and identification of the poison in viscera, etc.—
 ... obtained by Stas' process should be treated with water
 ... diluted with a few drops of diluted sulphuric acid, and then
 ... successively with ether and chloroform; the former
 ... take up any *Karabin*, and the latter *Neriodorin*, which
 ... be identified: (1) by their producing the peculiar acrid
 ... sensation on the tongue, followed by numbness; (2) by
 ... behaviour with concentrated sulphuric acid and fumes of
 ... acid, and with concentrated hydrochloric acid and heat;
 ... and (3) by the previously described toxic symptoms produced
 ... on animals.

BEHAVIOUR WITH CHARCOAL REAGENTS.

	<i>Neriodorin</i>	<i>Neriodorin</i>	<i>Karabin</i>
conc H_2SO_4 ..	Maroon - brown passing to vio- let. On ex- posure to the fumes of HNO_3 or bromine, no change was noticed	Yellowish-brown, on exposure to the fumes of HNO_3 or bro- mine, it imme- diately changes to a beautiful mauve-violet	Light brown; on exposure to the fumes of HNO_3 or bromine, a faint violet- brown colour develops after some time
a. $H_2SO_4 + KNO_3$	No change	Reddish-violet colour	No reddish vi- olet colour
c. $HCl + heat$..	No change	Dissolves to a yel- lowish solution, no separation of flocks	Partly bene- soluble, for- ing a green- yellow soln with separa- tion of flocks of dark green blue colour
Stas's solution +	No reduction	Reduction	No reduction
... 3 hours	Reduction	Reduction	No reduction

Fatal dose for an adult human being—Half a grain of *Karabin* nearly proved fatal to a cat. Two grains of *Neriodorin* killed a cat in 15 minutes. One grain of either of these substances may, therefore, be considered to be the fatal dose for an adult cat. From an analogy of the action of other vegetable poisons on cat and man, it will be within the mark if the fatal dose of either of these principles for the latter be fixed at five times that for a cat. In the case No. 4 about 180 grains of the root produce alarming symptoms, but did not prove fatal. As the root contains about one per cent. of *Karabin*, and probably an equal amount of *Neriodorin*, 250 grains (about $\frac{1}{2}$ ounce) of the root (which would yield 5 grains of the two active principles) may be taken as the average fatal dose for an adult human being. The *Neriodorin* of Mr. Greenish, which is a saponin only, may be neglected, as its toxic properties are of a much milder character than those of either *Karabin* or *Neriodorin*.

Yellow Oleander.

Cerbera Theretia, or *Theretia nerifolia*, Yellow or Exile or 'Bastard' Oleander; N.O. *Apocynaceæ*, *Pala-kanir* (Hind and Born.); *Kolkiphul* or 'yellow flower,' and *China Karab* or 'Chinese



FIG. 65.—*Cerbera theretia* $\times \frac{1}{2}$.

oleander' (Beng.); *Pach-chai-alari* (Tam.) (see Fig. 65).—This plant, a native of the West Indies, but domesticated in India, is highly poisonous. It contains a glucoside, *theretin*, a powerful heart poison, acting similarly to digitaline. It is

surface grey corky ; on young roots the corky layer is very thin and the interior yellow colour of bark is seen through it, inner surface yellow. The bark when cut or wounded exudes a pale yellow latex which is resinous and very sticky. Odour somewhat acrid, like that of a raw potato. Taste acrid and bitter

Tests.—The following tests are prescribed by Dr. C. L. Bose for the separation and identification of *Karabin* and *Neriodorin* in cases of poisoning by this plant.

Separation and identification of the poison in viscera, etc.—Extract obtained by Stas' process should be treated with water acidulated with a few drops of diluted sulphuric acid, and then agitated successively with ether and chloroform; the former will take up any *Karabin*, and the latter *Neriodorin*, which may be identified: (1) by their producing the peculiar acrid pricking sensation on the tongue, followed by numboess, (2) by their behaviour with concentrated sulphuric acid and fumes of nitric acid, and with concentrated hydrochloric acid and heat; and (3) by the previously described toxic symptoms produced on animals.

BEHAVIOUR WITH CHARCOAL REAGENTS.

	Neriodorein.	Neriodorin	Karabin.
Conc H_2SO_4	Maroon - brown passing to violet. On exposure to the fumes of HNO_3 or bromine, no change was noticed	Yellowish-brown; on exposure to the fumes of HNO_3 or bromine, it immediately changes to a beautiful mauve-violet	Light brown; on exposure to the fumes of HNO_3 or bromine, a faint violet-brown colour develops after some time
Conc. $H_2SO_4 + KNO_3$	No change	Reddish-violet colour	No reddish-violet colour
Conc HCl + heat	No change	Dissolves to a yellowish solution; no separation of floccs	Partly becomes soluble, forming a greenish-yellow solution with separation of floccs of a dark greenish blue colour
Fehling's solution + heat	No reduction	Reduction	No reduction
Boiled for 3 hours with 2 per cent. HCl , neutralized with KOH , and then heated with	Reduction	Reduction	No reduction

five times that for a cat. In the case No. 4 about 180 grains of the root produce alarming symptoms, but did not prove fatal. As the root contains about one per cent. of *Karabin*, and probably an equal amount of

Yellow Oleander.

Cerbera Thevetia, or *Thevetia nerifolia*, Yellow or Exile or 'Bastard' Oleander, NO *Apocynaceæ*, *Pila-hanir* (Hind and Bom), *Kolliphul* or 'yellow flower,' and *China Karab* or 'Chinese



FIG. 65.—*Cerbera thevetia* × ½.

oleander' (Beng); *Pach-chai-alar* (Tam.) (see Fig. 65).—This plant, a native of the West Indies, but domesticated in India, is highly poisonous. It contains a glucoside, *thevetin*, a powerful heart poison, acting similarly to digitaline. It is

chiefly used as a poison for suicide or by women who take it as an abortifacient. In Bengal it is especially used in Midnapur and Orissa. Of late years the seeds have come into somewhat extensive use in some parts of the Bombay Presidency as a cattle poison.

Symptoms.—The more prominent of these are a burning sensation in mouth, with tingling of tongue and dryness of the throat, vomiting and purging, with drowsiness and dilated pupils, and depression of the heart's action somewhat resembling digitalis, like which its symptoms may be divided into the stages of (1) excitation, (2) depression, and (3) paralysis. In one case a child *æt.* three, died with symptoms of tetanus after eating one seed, and in another case eight to ten of the seeds proved fatal to an adult female. A tincture of the bark has been used in medicine as an antiperiodic; thirty to sixty drops of a tincture, strength one to five, acts as a purgative and emetic.

Case—Yellow oleander poisoning—Suicidal.—A Hindu woman in the Contai District of Lower Bengal, in 1884, committed suicide by



FIG 66.—*Cerbera thevetia* Nuts. (Nat. Size.)

eating the seeds, some of which, together with the flowering tops, were sent for identification.—L. A. Waddell, *Ben. Chem. Ex. Rept.*, 1884, p. 16.

1

11 100 widow.

the deposit on the stone on which the seeds were rubbed with
(Report No. 1024B, 11th August, 1897.) She was tried by the Sessions Judge of Midnapore, and was sentenced to six months' imprisonment.

(b) Wedennis-a Bibi, a Mohammedan female of Jalalhabad, a village close to Contai, took two seeds on the 18th September, 1897, to commit suicide. She was admitted into hospital on the following day, suffering from purging, vomiting, pain alternating with drowsiness, and heart-sounds were (36 in a minute). The drowsiness gradually disappeared with the rise in the tone and frequency of the pulse. She was tried by the Subdivisional Magistrate of Contai, and



FIG. 67.—*Cerbera odallam*.

soft, irregular, compressible, was much troubled with a griping pain about the navel. The improvement in the pulse commenced with the abatement of headache and giddiness. She was tried by the Subdivisional Magistrate of Contai and sentenced to one week's imprisonment. (c) On the 24th November, 1898, Kumar Jana fell ill with purging, vomiting, giddiness in the head, and fainting fits after taking a meal of stale rice, left in an open pot by his wife, with whom he was not on good terms. He was brought to me for examination by the police on the night of the 25th November, when I found his pulse soft, compressible, and slow (52 in a minute); he looked dull, and walked with a slow and unsteady gait. I

gave my opinion that he was convalescing from *Korob* poisoning, which police, on inquiry, found to be correct. From the above cases it appears that this poison is used by women, not only to commit suicide and procure abortion, but also for homicidal purposes. The poison is a virulent cardiac

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Jadub Kisto Sen, *Ind. Med. Gaz.*, 1901, p. 412.

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plant abound in milky juice. The fruits are globular, light-green, about 1½ to 2 inches in diameter, and contain a single nut, light-brown in colour, and of a peculiar triangle shape (see Fig. 66), with a deep groove along the edge corresponding to the base of the triangle: each nut contains two pale yellow seeds.

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ness. The residue may then be washed with ether, and the

a rich crimson, which, on exposure, becomes deep-green at the edges.

This crimson colour, Dr. E. A. Hankin finds, develops best in the presence of traces of alcohol. The vomit of a person poisoned with *Cerbera* gives a blue colour when boiled with hydrochloric acid. Another specimen of the vomit should, in this case, be evaporated to dryness. On adding concentrated sulphuric acid no crimson colour appears. The acid should be poured off, and a few drops of alcohol poured over the residue. The crimson colour then appears. If a dry seed of *Cerbera* is crushed and placed in concentrated sulphuric acid, a strong crimson colour will develop on the addition of a few drops of alcohol.

Dr. C. L. Bose notes that besides the deep bluish green colour which the fresh bark or seed gives with warm hydrochloric acid (a test discovered by the late Dr. C. J. H. Warden), the seeds yield to the ethereal extract by Stas' process a white crystalline deposit (not an alkaloid, but more probably a glucoside) which, when applied to the tongue, produces a burning sensation accompanied by tingling, which often extends

to the lips. There is also dryness of the throat. This sensation generally lasts from half an hour to one hour, though the tip of the tongue may remain benumbed with a rawish feeling for a longer time. This sensation is not likely to be mistaken for that produced by *Aconitine* on the tongue, which lasts for more than six hours, and is of a less burning and more tingling character.

when heated with hydrochloric acid give a deep blue or bluish-green breadth. Fruits nearly globular, dark green, and contain in a cavity in the centre a single oval white seed.

Aconite.

Aconite is one of the most virulent poisons known. All the aconites (N.O. *Ranunculaceæ*) are poisonous, and some so extremely so that the general Indian vernacular name for them is *Bish* or *Bikh*, meaning 'the poison.' The most poisonous species are *A. ferox* and *A. napellus*, which Hooker was inclined to think were merely varieties of the same species. All parts of these plants are poisonous.

A. ferox (see Fig. 68) is a native of the Himalayas, and its root forms most of the aconite root of the Indian bazaars. It is believed to be even more actively poisonous than *A. napellus*, to which it is generally similar in appearance.

A. napellus, or 'monk's hood,' 'wolf's bane' or 'blue rocket,' is a common plant in England and grows also in the Himalayas. Its root and leaves are officinal. It is perennial, two to three feet in height, with dark-green digitate shaped (hence called) .
ous species are *A.* .
Kashmir to Kumaon .
natum in the eastern temperate Himalayas from Garhwal to Mishmi Hills in Assam, and *A. heterophyllum* in the North-western Himalayas. lar as *Bikhma*, *Bishma* of the latter as *Atis* (ml), *Atarakha in-kali* a those of the stronger omics and antiperiodics.

The root, sold in the Indian bazaars, is mostly derived from *A. ferox*, and is known under the names of *Bish*, *Bikh*, or *Bachnag* (or snake-bite preserver), *Mitha-bish* (sweet-poison), or (Hindi), *Bach-nab* (Bo.), *Vashnar* (Tamil). It is

met with in two forms:—(1) Conical roots, see Fig. 69, three to four inches long, and half to one and three quarters inches in greatest diameter, shrivelled with longitudinal wrinkles, and often flattened and arched. Externally they are blackish-brown, internally, from being dried over a fire, they are generally hard, horny, and brittle, and on section darkening slightly on exposure to the



FIG. 68.—*Aconitum ferox* $\times \frac{1}{2}$.

air. (2) The same roots, after subjection to some soaking process, generally stated to be soaking in oil (hence called *telyia*) and cows' urine. These are black, plump, conical tubers, cylindrical in section, tough and moist, and staining the fingers brown when fresh. When dry, they are hard and brittle, and have a reddish-brown resinous fracture. They have a strong offensive odour.

Its tubers are smaller, and *Bikkma* tubers about the same size as those of *A. ferox*, but branched. Both are externally much lighter in colour than the tubers of *A. ferox*. Both taste simply bitter, without



FIG. 69.—Aconite Root (*Aconitum ferox*), natural size

numbness of the lips, etc. It may be distinguished from horse-radish root, which is cylindrical, longer than aconite root, and externally of a light-buff colour. Rootlets attached to it are straight; chewed, it has a pungent taste, but does not cause tingling and numbness like aconite root. *A. ferox* is extensively collected for commerce from Sandukphu,¹ a mountain near Darjiling.

¹ Among the Himalayas, by L. A. Waddell, pp. 324-326. The name of this mountain, San-duk-phu, means, as Colonel Waddell first pointed out, "the hill of the aconite-plant."

The chief active principle of *A. napellus* is aconitine, while *A. ferox* owes its activity mainly to pseudo-aconitine which, although differing somewhat in composition and chemical properties, has the same physiological action as aconitine. Other less active alkaloids, some of which are not poisonous, are contained in both species, two of which, aconine and pseudo-aconine, are obtained by the action of heat from aconitine and pseudo-aconitine respectively.

Aconitine is one of the most active poisons known, if not the most active. It crystallizes with difficulty, so is usually met with as a white amorphous powder. The various kinds of commercial aconitine differ considerably in activity owing to more or less admixture with the other relatively inert alkaloids in the root of their derivatives.¹ English aconitine (Morson's) is more active than the German and is not bitter, but slightly soluble in water, but not very freely soluble in alcohol and ether, while the German alkaloid is soluble in all three and is bitter, this is owing to its containing a considerable proportion of the less active alkaloids, namely, aconine, which is 2000 times less active than aconitine, and benzaconin, which is 200 times less toxic.²

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71. ¹ *Howe and J. or Johnson respectively from a specimen of the root* gram, which is equivalent to 0.092 mgrm. per kilo of body weight for cats. But man is much more sensitive, as 1.6 mgrm. of French (Petit's) aconitine nearly proved fatal, whilst 4 mgrms. by the mouth was rapidly fatal, and it is probable that 1.5 mgrm., if injected subcutaneously, would prove fatal. The medicinal dose of the B.P. tincture, 5 to 15 minims, equals approximately 0.005 to 0.015 gram of aconitine; and 2 mgrm. of aconitine = 0.030 gram of the alkaloid or about 30 minims of the B.P. tincture.⁴

Poisoning by the root.—In India the root is extensively used by the wilder tribes of the Himalayas from Assam to Kashmir to poison arrows for the chase as well as for inter-tribal conflicts. In our military expeditions on the North-Eastern Frontier in Sikhim, Bhutan and Assam, several of the *Sepoys* have been mortally wounded by these poisoned arrows.

Several of these poisoned arrows used against our troops in the Aka expedition of 1884 were sent to Lieutenant-Colonel Waddell for examination and analysis, and the arrows were found to be smeared over with a

¹ See Blyth's Poisons, 352; and Allen's Commercial Analysis, iii, Pt II, for details.

² J. T. Cush, in *Benq. Med. Jour.*, October 8, 1893.

³ Blyth, Poisons, 357.

paste containing aconite.¹ The arrowheads were made of bamboo ingeniously contrived to carry the poison into the wound, and retain it there. For this purpose the surface of the arrowhead was sliced obliquely to form little pockets or valves, whilst others were constructed of dovetailed pieces tied together, and so arranged that any one trying to pull the arrow out of the wound merely pulls out the shaft and forces the barb and sharp splinters more deeply into the flesh (see illustration, p. 108). Septic blood is said to be mixed with the pounded root to increase its lethal effects.

In the poisoned arrows of the adjoining Abor tribe, Major Windsor reports (*Ind. Med. Gaz.*, 1912) that no aconite was found, but croton oil.

The Lepchas of Sikkim have a saying that aconite is "useful

poisoned with aconite root the water-supply of a detachment of British troops during the expedition of 1887. Similarly the Burmese during their retreat before the British in 1842 threw bruised aconite root into a tank in the hope of poisoning the troops pursuing them², and the Gorkhas did the same in the wells in the Sarau tarai against General Ochterlony's troops in the Gorkha War of 1814-16.

Accidental poisoning by aconite is occasionally met with as a result of its common occurrence in bazaars and its use as the drug by native quacks in the treatment of fever, etc. (see *Cases*, pp. 682-83); also from native alcoholic liquor, to which it is added occasionally (like datura) for the purpose of conferring additional intoxicating power,³ sometimes with fatal results. Homicidal cases are not unfrequently reported (see *Cases*, pp. 680-81), but are not so frequent as one might expect, considering how readily the drug can be obtained, and how well known are its poisonous properties. It is sometimes administered to the victim with betel-pepper,⁴ so as to disguise its tingling taste.

In 1898 in Madras aconite accounted for the largest number of deaths from poisoning with any organic poison, 14 persons having died out of 22 affected in 7 cases (*Mad. Chem. Ex. Rept.*, 1898); and Burton Brown records only nineteen cases in the Panjab in the years 1861-73. In Bengal, etc., for the three years ending 1872, only ten certain cases were recorded (five of them homicidal, and five doubtful cases); but of late it has increased. The Bombay Analyser's Reports for the ten years ending 1884 show only six cases, three of them accidental.

¹ L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 13.

In Europe, aconite is
Blyth, in the ten year
poisoning were recorded
were homicidal, seven.
be noted that in Europe,
root being eaten in mistake for horse-radish.

Action and Symptoms.—Aconitine or aconite root itself first stimulates the sensory nerves, producing tingling, and then paralyzes the sensory nerve-terminals, causing numbness. It produces similar effects on the motor nerves and centres of the medulla and cord, while the higher cerebral centres are little affected. The motor ganglia of the heart are paralyzed, the respiratory centre is slowed, death being usually due to arrest of respiration. The temperature sinks from the outset. **Symptoms.**—Aconite causes tingling followed by numbness; first, of the parts with which the poison has been in contact, *e.g.* the lips and tongue, and subsequently in all parts of the body. This tingling, followed by numbness, is a characteristic symptom of aconite poisoning. Irritation of the stomach is also caused; hence vomiting, sometimes violent, is generally a constant feature. There may be diarrhoea. From its paralyzing action on the motor nerves (or centres), and on the heart, other symptoms of aconite poisoning are:—great muscular weakness the patient staggers if he attempts to walk: the respiration becomes slow and weak, and the pulse slow, weak, and irregular. Death may occur from shock or syncope, but usually occurs from asphyxia due to paralysis of the respiration. Convulsions may precede death. The pupil in the early stages of the case alternately contracts and dilates, but becomes widely dilated in the later stage. The mind is usually quite unaffected, but in exceptional cases delirium has been observed. The case below well illustrates the symptoms of aconite poisoning.

Case—**Typical aconite poisoning.—Homicidal.**—In 1902, Monorath, the murdering a

complaining of intense faintness. His pulse became feeble, respirations jerky and laboured and limbs grew cold and moist to the touch. He grew gradually weaker and drowsy, and died within two hours of taking

Cases.—Homicidal aconite poisoning by liquor drugged with aconite.—

(a) In 1834, about 70 men, 18 of whom died, were poisoned at Benares by drinking Mowā liquor obtained at a particular liquor shop. One of the servants at the liquor shop afterwards confessed to having put aconite root into the liquor.—*Chivers, Med. Jur.*, p. 138. (b) In a case from Morā (Hyderabad Assigned Districts), a small bundle, taken out of the receiver of a country liquor still, was on examination found to contain a

1834. (c) *In pachwai*.—Several persons drunk *pachwai* in a liquor shop in the district of Birbhum. Soon after they all suffered from severe burning sensation in the stomach, tingling and numbness of the extremities and vomiting. Six of these persons died, and congestion of the stomach and other internal organs was found in most of the cases on *post mortem*.

Bose, *Beng. Chem. Ex. Rept.*, 1907.

tongue, and pain in stomach). Latterly giddiness supervened, the tingling

and numbness extended to his arms and legs

ed by his wife. Soon after he
 nd died in about two or three
 membrane of the stomach, which still contained much undigested food.
 The small intestine also presented a red appearance. The lungs and the
 liver were intensely congested; the brain, the spleen and kidneys were
 also congested. The viscera and the vomited matter of the deceased
 were forwarded for examination, and aconite was detected in them.—
 C. L. Bose, *Beng. Chem. Ex. Rept.*, 1906.

Cases —Accidental aconite poisoning.—(a) (*Bo. Chem. Analyser's Rept.*, 1875-76). In a case from Coompta a woman, after taking medicine given to her by a quack for menorrhagia, suffered from "restlessness, depressed and irregular heart's action, coldness of the surface, numbness and tingling of"

of a native hakim, swallowed some of the preparation of aconite root he was making for his master; death resulted, and on analysis aconite was found in deceased's viscera.—(d) A Tibetan, a Buddhist priest at Jalpaiguri in 1864, bought several articles of food which he cooked and partook of with his friend at 9 A.M., and within an hour was attacked with a burning

Fatal period.—Shortest recorded, twenty minutes, longest, twenty hours; usual, within three or four hours. Fatal dose—Of the root, one drachm (presumably of the root of *A. napellus*) has caused death. Chevers,¹ however, mentions a case in

¹ *Med. Jur.*, p. 143.

which fifteen grams of Indian aconite root gave rise to severe symptoms, and bad symptoms have been produced by inhaling the dust arising whilst powdering the root¹. The tincture of aconite B.P. and I.P. is prepared from the root of *A. napellus*, strength two and a half ounces to one pint. The medicinal dose of it is five to fifteen minims. Taylor² mentions two cases in which one drachm of the tincture caused death, and a case is reported in which fifteen minims of the tincture caused severe symptoms. In these three cases the tincture was probably that of the old London Pharmacopœia, which was three times as strong as that of the B.P. Another tincture of aconite, known as Fleming's Tincture, is three or four times as strong as the B.P. tincture³. A case is reported in which death is believed to have occurred from the too frequent external application of Neuraline, a preparation containing Fleming's Tincture. Another official preparation of the root is the Liniment—strength I.P. one to one, B.P. two to three. Lastly, the B.P. and I.P. both contain an alcoholic extract of the leaves (of *A. napellus*), medicinal dose one-sixth of a grain gradually increased. Two grains of the extract has caused death. One-fiftieth to one-fortieth of a grain of aconitine has caused alarming symptoms. Probably one-twentieth to one-sixteenth of a grain given by the mouth would usually cause death in an adult. Blyth considers that the minimum fatal dose, when given by the mouth, is even less than this, and that probably about one-fortieth of a grain subcutaneously injected would cause death. The only official preparation of aconitine is an ointment, strength eight grains to the ounce.

act.—C. L. Bosc, *Proc. Med. Cong.*, 1894.

Case—Homicidal aconite poisoning.—Lamson Case.—George Lamson, aged 29, a surgeon, was committed in London in 1682 for the murder of his brother-in-law Percy John, aged 19, a cripple, who had property which would, on his death, revert to Lamson's wife, John's sister. On November 24th, 1680, Lamson purchased two grains of aconitine, and on

¹ Woodman and Tidy, *For Med.*, p. 334.

² *Poisons*, p. 756.

³ Blyth, *Poisons*, p. 334.

December 3rd w
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Stevenson of Guy's Hospital, who found aconite present in the viscera, contents of stomach and urine, and he considered that the vomit contained a quarter of a grain of aconitine. Sentence of death was passed. An attempt

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refused to interfere, and he was executed.

Treatment.—Evacuate contents of the stomach, administer animal charcoal and stimulants. Keep the patient in a recumbent posture, apply friction to the surface and keep up artificial respiration. Blyth recommends hypodermic injection of atropine (4 drops of B.P. solution), repeated from time to time, and if tendency to syncope, tincture of digitalis in half-drachm doses by the mouth or ten-drop doses subcutaneously—see following case.

Post mortem signs—General venous congestion, congestion of the brain and its membranes, and frequently, if the poison has been taken by the mouth, some signs of gastrointestinal irritation.

DETECTION.—Aconitine (or pseudo-aconitina) may be extracted from organic mixtures by Stas' process, p. 535, conducting the evaporation at as low a temperature as possible, and using a mixture of chloroform and ether as a solvent. There are no reliable special colour tests for these alkaloids. They may, however, be identified by physiological tests, namely, by the tingling and numbing sensation produced by a cautious application of a solution of the alkaloid to the tongue or lip, and by the effects produced by administration of the alkaloid to smaller animals.

The Goat for physiological Aconite tests.—As the physiological test is the chief one for aconite, and aconitine is one of the most deadly poisons

datura, these articles having presumably been found in the possession of the accused. As a preliminary test, a small quantity of an ethereal extract of the brown powder was introduced into the eye of a kid, in order to observe whether the dilatation of the pupil characteristic of *datura* resulted. The symptoms noted were 'In 20 minutes great muscular weakness, staggering gait, the animal appearing to lose control of all its limbs, and occasionally falling down, the forelegs in particular seem to give way at the knees even when the animal stands still. Breathing laboured and irregular. No dilatation of the pupils.' The symptoms passed off in a few hours, and next morning the kid was quite well. Aconite was at once suspected from the above symptoms, and the case subsequently proved to be one of combined aconite and arsenic poisoning. The only reason for suspecting *datura* appears to have been the presence of the *datura* capsule noted above. The medico-legal interest in the case lies in the marked symptoms that followed the introduction of a very small quantity of aconitine, the active principle of aconite, into the goat's eye, and the possibility that this might be utilized as a toxicological test for aconite.

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aspidospermine and quebrachine, has a paralyzing action on voluntary movement and respiration, and appears, therefore, to be a spinal poison. Tobacco and lobelia, also, are spinal as well as cardiac poisons.

The importance of sending, in every case of suspected poisoning, the vomited matter as well as the viscera from fatal cases is illustrated in the following cases:—

Cases.—Detection of aconite poisoning in the vomit and not in the stomach.—(a) A resident of Dinajpur prepared one morning his usual curry, one half of which he ate and the other half he reserved for his evening meal. On return from his day's work he mixed this curry with his fresh
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and its contents; (2) two pieces of the liver; (3) matter vomited by deceased, and (4) some of the food of which deceased was partaking when attacked. On chemical examination no poison was found in the stomach and its contents, nor in the liver; but aconite was found both in the vomited matter and in the food. Hence had only the stomach

patches; kidneys intensely congested; also lungs; heart relaxed. Aconite was not detected in the stomach and contents, but only in the vomited matter.—L. A. Waddell, *Beng. Chem. Ex. Rept.*, 1884, p. 5.

In view of the minute quantity of the poison usually used to produce a fatal result, and in view of its liability to

decompose, it is probable that it has never been detected after absorption into the tissues. It may be found in the contents of the stomach before absorption, and also, more frequently, may be detected in the vomit. In a case that occurred in the United Provinces it was detected in a stain on the pyjama of a woman, but it could not be found either in the vomit or in the viscera. The vomit in this case had been mixed with wood ashes. Such ashes contain a quantity of alkali. Alkali is known to decompose

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wood ashes have the power of slowly destroying aconite, and that this power was due to the presence of alkali. The addition of alcohol to a mixture of ashes and aconite was found to check the decomposition. The decomposition was found to be still further checked if acetic acid was added besides alcohol, though the quantity of acid used was not sufficient to neutralize the whole of the alkali present.

The *Colchicums* which exert an asthenic action on the heart have already been described amongst the irritant vegetable poisons, see p. 540.

Hydrocyanic or Prussic Acid.

Poisoning by hydrocyanic acid, common in England, was some years ago almost unknown in India. Of late years, however, a few suicidal cases have been reported by the acid and by cyanide of potassium, see *Case*, p. 690.

acid met with in commerce called Scheele's acid contains 5 per cent.

Certain portions of many plants contain hydrocyanic acid, or yield it under appropriate treatment, owing to the decomposition of amygdalin, or substances allied to amygdalin (see 'Essential oil of bitter almonds'). Hydrocyanic acid swallowed, inhaled in the form of vapour, or otherwise introduced into the system, paralyzes both the brain and the spinal cord, causing insensibility and loss of muscular power. Death from large doses occurs rapidly by syncope, due to arrest of the heart's action, or from smaller doses less rapidly by asphyxia, due to paralysis of respiration.

Symptoms. These vary to a certain extent with the dose. Small poisonous doses cause a hot bitter taste, giddiness, pains in the head, and confusion of intellect, followed by insensibility and loss of muscular power. The eyes are bright and prominent, the face pale, and salivation is frequently present. The breathing often becomes stertorous, the breath smells of hydrocyanic acid, and in a very short time (see 'Fatal period') death takes place by asphyxia. Lock-jaw and tetanic convulsions, and involuntary expulsion of urine and feces, often precede death. Vomiting has been observed, but is not a common symptom. Large poisonous doses cause almost immediate insensibility and rapid death from syncope. In rapidly fatal cases convulsions are not usually present, but there may be involuntary expulsion of urine and feces. In cases of this class, death usually takes place with a forcible expiration, which may or may not be accompanied by a shriek. Some of the more important medico-legal questions which may arise in cases of poisoning by hydrocyanic acid are as follows:—

1. **Interval between swallowing the poison and insensibility.**—Large doses given to animals cause almost immediate insensibility. In man, the action of the poison appears to be less rapid: insensibility may, however, come on in a few seconds, and is rarely, if a full dose has been taken, delayed beyond the second minute. Still, however, even when a full dose has been swallowed, considerable power of volition and locomotion may remain, and various acts may be performed in the short interval

cyanic acid to the extent, it is said, of 1 to 4 grains in a pint. Hydrocyanic acid is also contained in chlorodyne (see p. 609).

Fatal period and dose.—Large doses have been found to

* Peach kernels contain rather less amygdalin than cherry kernels; kernels contain rather more amygdalin than apple pips.

kill the lower animals almost instantaneously. In man death occurs less rapidly, but has occurred as early as the second minute, and as late as one and a half hours after swallowing the poison. When the dose is $1\frac{1}{2}$ drachms or more of the B.P. acid, the average fatal period is two to ten minutes. The smallest dose which has proved fatal to an adult is 0.9 grain of anhydrous acid, death occurring in twenty minutes; recovery has, however, taken place from 2.4 grains. One grain of the anhydrous acid may, but will not necessarily, prove fatal. In estimating the amount taken, it is important to recollect that drops and minims are not necessarily the same. Woodman and Tidy state that ten drops of hydrocyanic acid equal on an average 20 minims¹. It may be further noted that dilution seems to make no difference to the action of the poison, but exhaustion from any cause, such as fatigue, favours its action; also that, although it has been asserted that hydrocyanic acid may act as a cumulative poison, the weight of evidence is greatly against its so acting. **Treatment.**—The best antidote is a mixture of a ferrous and ferric salt, with a little caustic soda or potash, or, if caustic alkali is not obtainable, with

of weak ammonia, and to employ artificial respiration.

Post mortem signs.—These may be nil, but are generally similar to those of death from asphyxia. The odour of hydrocyanic acid is often, but not always, perceptible in the body, in the brain and muscles, as well as in the stomach. The smell of hydrocyanic acid has been detected in the stomach seven or eight days after death.

Tests.—Distil the viscera in a stream of carbonic acid gas. Heat gently, as the prussic acid is very volatile. Interrupt the distillation as soon as about 20 c.c. have come over. The receiver in which the distillate collects should be surrounded by ice.

The distillate should be tested for prussic acid as follows:—

(1) Make "*Schoenbein's test paper*" in the following way. Grind up a few grains of guaiacum resin in a mortar. Add 10 c.c. of absolute alcohol and continue grinding until the guaiacum is dissolved. Small strips of filter paper are then to be wetted with this solution. Allow them to dry. Wet a

¹ According to the same authorities, ten drops of chloroform or of tincture of opium equal five to six minims, and ten drops of the following tinctures equal six to eight minims:—aconite, digitalis, and hyoscyamus.

piece of this paper with 1 in 1000 copper sulphate solution. If it is then held over a liquid containing prussic acid or a cyanide the paper will turn blue. If the paper remains colourless a certain proof has been obtained that prussic acid is absent. If the paper turns blue, there is only a presumption that prussic acid is present. The paper is only sensitive when freshly prepared. It slowly turns blue if kept for a few days.

(2) *Berlin blue* reaction.—Add to a portion of the distillate a small quantity of pure caustic soda or potash. Add a drop of ferrous sulphate solution and a drop of a solution of ferric chloride. Warm gently just to the boiling point. Do not filter. Cautiously acidify with hydrochloric acid. In the presence of prussic acid or a cyanide a blue precipitate of Berlin blue is formed. If only traces of cyanides are present, the solution turns green, and blue floculi slowly deposit.

(3) The *Nitro-prusside* test. To a portion of the distillate add a few drops of potassium nitrate solution, and two to four drops of ferric chloride solution. A brownish-yellow colour is thereby produced. Add sufficient sulphuric acid to change this colour to pale yellow. Heat till the mixture begins to boil. Allow to cool. Add a few drops of ammonia. Filter and add to filtrate a drop or two of a very dilute and colourless solution of ammonium sulphide. If a cyanide is present a violet colour is produced. In a few blue, green and yellow.

are present the colour is ————. If traces of alcohol are present, as will be the case if the viscera have been preserved in alcohol, the colour at first produced will be yellow instead of violet (Hankin).

If analysis does not detect it, death may nevertheless have been due to poisoning by hydrocyanic acid. A case is recorded of death from hydrocyanic poisoning, in which analysis twenty-six hours after death failed to detect the poison. On the other hand, it has been detected by analysis seventeen, twenty-one, and even twenty-three days after death, and may be detected even if no odour of the acid is perceptible. Although analysis detects it, it may possibly be objected that the poison found (a) has been yielded by apple-pips, cherry-kernels, or the like, hence the contents of the stomach, vomited matter, etc., should always be carefully searched for such bodies, which, if found, should be separated before proceeding with the analysis ;

more ;

(c) Has been produced by the action on organic matters of

the heat employed in distillation. A high temperature, much higher than that of a salt-water bath, would be required, however, to produce even traces in this way.

Case.—Hydrocyanic acid poisoning—suicidal.—A Bengali Hindu, aged about 36, was found restless in his bed for a few minutes, and then expired. Two empty phials which had contained hydrocyanic acid were found near the deceased. At the *post mortem* examination the stomach was found dilated and empty, the mucous membrane was deeply congested, and covered with thick, sanious-looking, tenacious mucus. No smell of hydrocyanic acid was detected in the stomach. The viscera were sent for chemical analysis by the Civil-Surgeon of the 24 Parganas, and hydrocyanic acid was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Case.—Hydrocyanic acid—theft and murder.—A case of murder by

the presence of hydrocyanic acid. The ornaments of the woman were missing. The murderer still remains undetected.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907.

Essential oil of bitter almonds, *Benzoyl hydride*, or *Benzole aldehyde*, is obtained by distillation of an emulsion of the cake left after expression of the fixed oil from bitter almonds. It is formed by the fermentative action of emulsion, present both in sweet and bitter almonds, on amygdalin, a glucoside present in the bitter, but not in the sweet, variety. During the decomposition, hydrocyanic acid is also produced, which, if not removed, renders the oil poisonous. Essential oil of bitter

four to eight parts of rectified spirit, it forms the almond flavour or essence of the shops, sold for the purpose of flavouring confectionery. Bitter almond water, another preparation, contains hydrocyanic acid to the extent of 0.25 to 1.0 per cent. A fatal case of poisoning by bitter almonds in an adult female is also reported. The quantity taken was estimated at about 1200 grains. The symptoms, treatment, etc., in poisoning by essential oil of bitter almonds are the same as in poisoning by hydrocyanic acid. Hydrocyanic acid may be detected in it by the vapour tests, or by applying the tests for the acid to water

which has been shaken with the oil. The purified oil—from experiments on animals—acts as an intoxicant, but is very much less poisonous than the crude oil. Water distilled from the following also contain hydrocyanic acid derived from decomposition of amygdalin, or a substance allied to it: the leaves of the cherry laurel (*Prunus laurocerasus*); the flowers, bark, seeds and leaves of the mountain ash (*Sorbus aucuparia*), and the bark, seeds, and leaves of the cluster cherry (*Prunus padus*). One ounce of cherry laurel water has proved fatal to an adult, and in a celebrated case (murder of Sir T. Broughton, 1781) two ounces proved fatal in half an hour. The blossoms of the peach also have, from a similar case, in two cases caused death.

Cyanides of potassium, Sodium and Ammonium are all intensely poisonous. Cyanide of potassium, more commonly

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silver cyanide dissolved in cyanide of potassium solution. Fatal cases have been reported from swallowing this solution as well as from swallowing cyanide of potassium; and serious symptoms have arisen from the absorption, through abrasions on the skin, of cyanide of potassium employed for the purpose of removing silver stains from the hands. Two and a half grains of pure potassium cyanide may be regarded as a minimum fatal dose. The commercial salt is, however, generally impure from the presence of potassium carbonate, produced by the action of the carbon dioxide of the air on the cyanide. In an exceptional case recovery took place after swallowing more than half an ounce of the commercial salt. The symptoms, etc., are the same as in poisoning by hydrocyanic acid. Probably, however, after death more evidence of irritation will be found.

Case.—Cyanide poisoning—Corrosive action.—A case, remarkable for
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the poison.—*Ind. Med. Gaz.*, 1902, p. 300.

Cases.—Prussic acid poisoning by cyanides—Suicidal.—(a) A respectable-looking Bengali Hindu, aged about 23 years, was found dead on a bench in the Eden Gardens, Calcutta, on the 11th July, 1893. A bottle

the heat employed in distillation. A high temperature, much higher than that of a salt-water bath, would be required, however, to produce even traces in this way.

Case.—Hydrocyanic acid poisoning—suicidal.—A Bengali Hindu, aged about 36, was found restless in his bed for a few minutes, and then expired. Two empty phials which had contained hydrocyanic acid were found

chemical analysis by the Civil-Surgeon of the 24-Parganas, and hydrocyanic acid was detected in them.—C. L. Bose, *Beng. Chem. Ex. Rept.*, 1907

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four to eight parts of rectified spirit, it forms the almond navour or essence of the shops, sold for the purpose of flavouring confectionery. Bitter almond water, another preparation, contains hydrocyanic acid to the extent of 0.25 to 1.0 per cent. A fatal case of poisoning by bitter almonds in an adult female is also reported. The quantity taken was estimated at about 1200 grains. The symptoms, treatment, etc., in poisoning by essential oil of bitter almonds are the same as in poisoning by hydrocyanic acid. Hydrocyanic acid may be detected in it by the vapour tests, or by applying the tests for the acid to water

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Cyanides of potassium, Sodium and Ammonium are all intensely poisonous. Cyanide of potassium, more commonly met with than the others, contains cyanogen equal to about 40 per cent of hydrocyanic acid. It is largely used for various purposes in the arts, *e.g.* in cleaning gold and silver lace, plate, etc., by photographers for removing silver stains; and by electro-platers, the ordinary electro-plating solution being silver cyanide dissolved in cyanide of potassium solution. Fatal cases have been reported from swallowing this solution as well as from swallowing cyanide of potassium; and serious symptoms have arisen from the absorption, through abrasions on the skin, of cyanide of potassium employed for the purpose of removing silver stains from the hands. Two and a half grains of pure potassium cyanide may be regarded as a minimum fatal dose. The commercial salt is, however, generally impure from the presence of potassium carbonate, produced by the action of the carbon dioxide of the air on the cyanide. In an exceptional case recovery took place after swallowing more than half an ounce of the commercial salt. The symptoms, etc., are the same as in poisoning by hydrocyanic acid. Probably, however, after death more evidence of irritation will be found.

Case.—Cyanide poisoning.—Corrosive action.—A case, remarkable for the corrosive effects of the crude drug owing to contamination with carbonate and caustic potash, is reported by Dr. A. Powell. The angles of the lips, the mucosa of the
were whitened, feeling soapy to
was dissolved, leaving a red, r.
was found to have disappeared
The autopsy was made four hours after death. Several witnesses deposed that death took place between seven and twelve minutes after swallowing the poison.—*Ind. Med. Gaz.*, 1902, p. 306.

Cases.—Prussic acid poisoning by cyanides.—Suicidal.—(a) A respectable-looking Bengali Hindu, aged about 23 years, was found dead on a bench in the Eden Gardens, Calcutta, on the 11th July, 1899. A bottle

containing cyanide of potassium was found tied in his chaddar. In his right hand were found three lumps of potassium cyanide; a reddish froth was issuing from his mouth. In the pocket of his coat was found a tram ticket for the Chitpore car. Some prepared betel, a knife, and a slice of ripe mango were found close to the dead body. The body could not be identified. The viscera were forwarded for chemical examination, and prussic acid was discovered in them. It is evident that the man went to the Eden Gardens to commit suicide by taking cyanide of potassium. Cyanide of potassium is freely sold in shops in the bazaar without any restrictions. (b) In another fatal case, in 1899, a gilder committed suicide by drinking some silvering solution (cyanide of silver dissolved in cyanide of potassium).—*L. A. Waddell, Beng. Chem. Ex. Rept., 1899*

Rept., 1911.

ing with John Hunter as medical
ical Journal of August 23, 1899,
s the case of the *King v. Donellan*,
the celebrated John Hunter made
his appearance upon the witness stand in that case. In 1790 Captain
Donellan was put upon trial for the murder of his brother-in-law, Sir
Theodosius Boughton. Donellan and Boughton lived in the same house,
and it was known that the former would benefit pecuniarily by the
death of the latter. An apothecary had prescribed for Boughton, and
the draught
mother of
it smelled
in convuls
contained the medicine
room, which he had given to a servant to clean a few days previously, it
having been recently used. The medicine which had been administered

the following comment on the testimony of Mr Hunter: "For the

causes. I wished very much to have got a direct answer from Mr. Hunter, if I could, what upon the whole was the result of his attention and appli-

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single number of the *Philosophical Transactions*, and of this volume the

case.

Mercuric cyanide.—This, already mentioned as a poisonous mercuric salt, according to some authorities, acts like hydrocyanic acid. Silver cyanide also, from experiments on animals, appears to act like hydrocyanic acid, but is much weaker; it contains cyanogen equal to about $\frac{1}{3}$ th of its weight of hydrocyanic acid. A case of attempted suicide by swallowing cyanide of silver, in which recovery took place under prompt treatment, occurred near Poona a few years ago.

Potassium ferrocyanide.—Yellow prussiate of potash under ordinary circumstances, is either not poisonous or only very feebly poisonous. When acted on by acids, however, it yields HCy. In one case, death resulted from swallowing a dose of this salt, followed by one of tartaric acid; and in another, from swallowing a dose of the salt, followed by a mixture of nitric and hydrochloric acids. Other ferrocyanides probably act

similarly to potassium ferrocyanide. Potassium sulphocyanide is poisonous, but not very active. The cyanates (from cyanic acid, HCNO) are asserted to be non-poisonous. Cyanuric acid, however, Blyth states, causes symptoms and effects similar to those produced by hydrocyanic acid.

Other cardiac poisons.—In addition to the foregoing the following vegetable irritants already described appear to possess an action on the heart similar to those possessed by digitalin: Scillitin, the active principle of squill, and probably also superbine, from *Gloriosa superba*. Helleborein, from *Helleborus niger* and *H. viride*. Anemonin, from *Anemone pulsatilla*, etc., and Adonidin, from *Adonis vernalis*.

An action on the heart similar to that of digitalin appears also to be possessed by the following: Antiarin, a glucoside contained in *Antiaris toxicaria*, a native of Java, where the milky juice of the plant is used as an arrow poison. Strophantin, a poisonous principle contained in *Strophantus hispidus*, N.O. *Apocynacea*.—Apocynin, a poisonous principle contained in the root of *Apocynum cannabinum*. Erythrophleine, an alkaloid obtained from the bark *Erythrophloeum guineense*, a native of West Africa. Euonymin, a
atropurpureus: and by Tap
 ordeal poison. Saponin and
 to possess an action on the
 digitonin.

Asphyxiants.

Carbon dioxide, carbonic acid gas.—The gas is a product of respiration, combustion, and fermentation, and of the decomposition of organic matter. It is also evolved during the decomposition of carbonates by heat, as in lime-burning; or by acids, as in the chemical preparation of the gas. Poisoning by carbon dioxide is usually accidental. In some countries, however, e.g. France, exposure to the fumes arising from a pan of burning charcoal placed in a room, the door, windows, etc., of which have been tightly closed, is a favourite method of committing suicide. (See also 'Carbon monoxide'.)

Accidental cases may arise from the carbon dioxide disengaged in any of the ways mentioned above. For example, from carbon dioxide evolved as a product of (1) Respiration, as when they occur in consequence of a number of persons sleeping in a small, badly ventilated room. (2) Combustion, in a similar way to the suicidal cases mentioned above. Accidental

cases of this kind have occurred in India (see *Case (a)* below). Under this head also come cases of poisoning by 'choke damp,' or carbon dioxide, formed as a product of coal-mine explosion. (3) Fermentation; carbon dioxide, evolved in this way is liable to accumulate in vats, in which fermentation has been conducted, *eg* brewers' vats rendering descent into the vat, in order to clean it, dangerous to life. (4) Decomposition of organic matter. Carbon dioxide thus produced is liable to collect in old wells, pits, vaults, etc., and to give rise to accidents. Descending into pits used for storing grain, which have been closed for some time, may result in death from carbon dioxide poisoning. A case of this kind occurred in 1888, in the hold of a ship at Calcutta (see *Case (a)*). (5) Decomposition of carbonates. Persons sleeping close to a lime-kiln have died of carbon dioxide poisoning; and Taylor mentions a case of accidental poisoning, arising from the use of chalk to neutralize a quantity of nitric acid which by accident had leaked into a room.

Cases.—Accidental poisoning by carbon dioxide.—(a) Dr. Moffat reports that four men were brought one morning to the dispensary at Naini Tal in a state of insensibility. They had been found in a closed room 6 x 8 x 7 feet, with a pan of charcoal between them. The

Nowshera.—See *ib*, March, 1885.

Cases.—Poisoning by gases from decomposing grain.—(a) In 1888 thirteen men were poisoned by gas in the hold of the steamer *Clan McIntosh* at Calcutta. A few days before the catastrophe a lot of fodder (hay) which had been kept on deck in one of the sheep pens was, owing to heavy weather, put into the lower storeroom, which also contained some bags of grain, paddy, gram, barley, etc. This fodder may have

purpose of sleeping, were the men brought on deck. Of thirteen persons who entered the lower storeroom eight retired on being brought on deck. The

retted hydrogen gas and carbonic oxide. (b) (*Ind. Med. Gaz.* for 1874, p. 295).—Dr. Gardner, of Saharunpur, reports a case in which three men died shortly after descending into a pit used for the purpose of storing grain. The pit had just been opened, but instead of, as is customary, leaving it open for some time before allowing any one to descend, the owner, being afraid of rain, sent his servants, four in number, down at once. The fourth man was also attacked, but recovered. The *post mortem* appearances in the three fatal cases were those of death from apnoea, with numerous sub-plural ecchymoses, of a dark purple colour.

Symptoms.—When undiluted, carbon dioxide causes spasm of the glottis and death from apnoea; diluted, it appears to act as a narcotic poison,¹ causing narcotism, followed by coma and death. The more the gas is diluted, the more gradually it produces its effects. If much diluted, there is at first headache, giddiness, and ringing in the ears, gradual loss of muscular power. Usually the face is livid, and there is palpitation, and hurried respiration. Gradually narcotism supervenes, deepening into coma with stertorous breathing. Sometimes vomiting and convulsions are present.

Toxic percentage.—Considerable difference of opinion exists on the question, what percentage of carbon dioxide present in air may be considered to render it poisonous? When carbon dioxide is simply added to air containing its normal percentage of oxygen, probably eight to ten per cent.—some say more—would be required. When developed at the expense of the oxygen of the air by respiration, probably five per cent. would suffice; very much less than this would probably cause distress in most persons, and two per cent., it is stated, occasions severe suffering. When developed at the expense of the oxygen of the air by combustion, carbon monoxide is usually at the

air containing a poisonous percentage of carbon dioxide.

At mortem signs.—The face may be pale or livid and
A. The tongue is often protruded and grasped by the
disengaged sometimes there is froth at the mouth and nostrils.
from ear.

as when told by some that carbon dioxide is not poisonous, and that its
sleeping in various action on animals is simply due to their being deprived
similar way,

Internally, the appearances are similar to those of death by apnoea. Usually there is much congestion of the brain and its membranes, and of the abdominal viscera.

Thus, if a person is found at once into pure air, affusion and galvanism

are resorted to. There is much congestion, moderate bleeding may be resorted to. Obviously, if a person on descending into a pit or vat is seen to fall immediately insensible from poisoning by carbon dioxide, to allow others to descend to his rescue is apt to lead only to a useless waste of life. Taylor cites a case where two men lost their lives in this way in attempting to rescue a boy who had fallen into a brewer's vat. Before persons are allowed to descend, the carbon dioxide should be chased out by driving fresh air into the pit or vat; or lime may be thrown down to absorb the gas.

Quantitative poisoning.—This may be effected by filling a large narrow-necked vessel of known capacity with the air to be examined, and adding a measured quantity of lime-water, the alkalinity of which has been first ascertained by a standard solution of oxalic acid. The vessel is then tightly closed, well shaken, and allowed to remain at rest for twenty-four hours. After this, the bottle is opened, the fluid poured out, a measured quantity (say equal to half the volume of the fluid originally poured into the bottle) separated, and the loss of alkalinity ascertained by titration as before, with standard oxalic acid solution. The loss of alkalinity of the whole fluid corresponds to the amount of

A candle or small lamp gives off about half a cubic foot per hour. If charcoal has been burnt in the room, the amount of carbon dioxide² evolved may be approximately inferred from the weight of the residual

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Carbon monoxide, or carbonic oxide.—*Carbon monoxide*

¹ As the air gets vitiated the amount given out per hour decreases a little

² A portion of the carbon, however, will probably have become converted into carbon monoxide, which is more poisonous than carbon dioxide

remaining five bodies were not recovered for two hours and a half, and when they were, life was extinct. The surgeon of the ship was in attendance, and rendered every aid in his power. He deposed that the five men died of asphyxia, and that the eight who recovered suffered from symptoms of asphyxia. He thought this was due to a mixture of carburetted hydrogen gas and carbolic oxide. (b) (*Ind. Med. Gaz.* for 1874, p. 295).—Dr. Gardner, of Saharunpur, reports a case in which three men died shortly after descending into a pit used for the purpose of storing grain. The pit had just been opened, but instead of, as is customary, leaving it open for some time before allowing any one to descend, the owner, being afraid of rain, sent his servants, four in number, down at once. The fourth man was also attacked, but recovered. The *post mortem* appearances in the three fatal cases were those of death from apnoea, with numerous sub-plural ecchymoses, of a dark purple colour.

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the face may be pale or livid and protruded and grasped by the hands at the mouth and nostrils.

* It is alleged that apparently poisonous oxide is not poisonous, and that its effects are simply due to their being deprived of oxygen.

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Internally, the appearances are similar to those of death by apnoea. Usually there is much congestion of the brain and its membranes, and of the abdominal viscera.

Treatment.—Remove the patient at once into pure air. Endeavour to restore sensibility by cold affusion and galvanism. Employ artificial respiration, and if there is much congestion, moderate bleeding may be resorted to. Obviously, if a person on descending into a pit or vat is seen to fall immediately insensible from poisoning by carbon dioxide, to allow others to descend to his rescue is apt to lead only to a useless waste of life. Taylor cites a case where two men lost their lives in this way in attempting to rescue a boy who had fallen into a brewer's vat. Before persons are allowed to descend, the carbon dioxide should be chased out by driving fresh air into the pit or vat, or lime may be thrown down to absorb the gas.

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is obtainable by passing carbon dioxide over red-hot charcoal. A certain quantity of it is always formed during the combustion, under ordinary conditions, of charcoal or other carbonaceous fuel, the amount being greatest when the combustion is least active, and *vice versa*. It is a powerful narcotic poison, much more powerful than carbon dioxide. Death from inhalation of the products of combustion, *e.g.* the fumes of burning charcoal, is probably in many cases due to carbon monoxide poisoning. After death from poisoning by carbon monoxide, the blood is found bright red in colour, not darkened, as in carbon dioxide poisoning. This is held to be due to the carbon monoxide forming, with the hæmoglobin of the blood, a compound of a red colour (carbonic oxide hæmoglobin). It is asserted by some that this compound is so stable that it cannot be broken up by simple exposure to air or oxygen; and hence, that in poisoning by carbon monoxide, artificial respiration is useless, and transfusion of arterial blood the only remedy. Others deny this, and hold that the compound does break up on exposure of the blood to air.

When lay down at a distance, finally died. *Post mortem* The blood of all characteristic spectrum.—Prof. A. Powell, *Notes*, 1917.

Coal gas.—The escape of this gas into badly ventilated rooms has frequently given rise to poisoning. The chief (according to some, is carbon monoxide. coal gas is present varies in different specimens. Usually the amount present is 5 to 11 per cent. has, it is stated, been found in coal largest quantity in coal. hydrogen (40 to 45 per cent. or more). Methane, even when present in air in quantity sufficient to form an explosive mixture (5½ per cent. or over), appears to exert little or no toxic action. Its presence in air, however, is a source of danger to life from the risk of an explosion, which may cause mechanical injury or result in poisoning by carbon dioxide.

Sewer gas may contain, in place of sulphuretted hydrogen, the vapour of hydrosulphide of ammonium, which appears to be equally poisonous. Or again, sewer gas may only contain sulphuretted hydrogen in small quantity, and but little carbon dioxide, but still produce asphyxia in those breathing it, owing to its consisting almost wholly of nitrogen, *i.e.* of deoxygenized air.

Sulphuretted hydrogen, H_2S .—The decomposition of organic matter may result in the production of this gas, directly, when the matter undergoing decomposition contains sulphur, indirectly, when the decomposition takes place in presence of a soluble sulphate. In the latter case the sulphate yields a sulphide which, when acted on by carbonic or other acids, evolves H_2S . Accidental poisoning by sulphuretted hydrogen is liable, therefore, to occur from exposure to the emanations from decom-

tion of the gas. **Symptoms.**—When concentrated, it causes immediate

exhales an offensive odour, putrefaction is rapid, and the blood is fluid and dark-coloured, there is a general congestion of the viscera, and engorgement of the right side of the heart. Woodman and Tidy lay stress on the presence of a dirty brown deposit smeared over the lining membrane of the bronchial tubes, as characteristic of death from sul-

Nitrous oxide or Laughing gas.—This is used as an anæsthetic instead of chloroform, and has caused several deaths. Death from inhalation of laughing gas appears to be due to asphyxia; indeed, it has been asserted that the anæsthetic effect of the gas is due to the production of temporary asphyxia, owing to the circulation of non-oxygenated blood, the blood having no power to separate the oxygen contained in this gas.¹

in factories where the vapour is evolved. In these cases have been a stage of excitement, followed by one of depression. The first stage begins with headache, indigestion and nausea, and

¹ Joykt and Blanche, quoted by Taylor, *Med.-L.*, p. 415.

is obtainable by passing carbon dioxide over red-hot charcoal. A certain quantity of it is always formed during the combustion, under ordinary conditions, of charcoal or other carbonaceous fuel, the amount being greatest when the combustion is least active, and *vice versa*. It is a powerful narcotic poison, much more powerful than carbon dioxide. Death from inhalation of the products of combustion, *e.g.* the fumes of burning charcoal, is probably in many cases due to carbon monoxide poisoning. After death from poisoning by carbon monoxide, the blood is found bright red in colour, not darkened, as in carbon dioxide poisoning. This is held to be due to the carbon monoxide forming, with the hæmoglobin of the blood, a compound of a red colour (carbonic oxide hæmoglobin). It is asserted by some that this compound is so stable that it cannot be broken up by simple exposure to air or oxygen; and hence, that in poisoning by carbon monoxide, artificial respiration is useless, and transfusion of arterial blood the only remedy. Others deny this, and hold that the compound does break up on exposure of the blood to air.

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top of the coal, and water continually poured on. As a result of these

... who recognized the symptoms, carried the ... a distance, finally being himself overcome. Seven of the twenty-three died. *Post mortem*.—I found them all of a bright red colour in patches. The blood of all was of the characteristic cherry-red colour, and gave the characteristic spectrum.—Prof. A. Powell, *Notes*, 1917.

Coal gas.—The escape of this gas into badly ventilated rooms has frequently given rise to narcotic poisoning. The chief (according to some, the only) poisonous constituent of coal gas is carbon monoxide. The quantity of carbon monoxide present varies in different specimens. Usually the amount present is 5 to 11 per cent., but as much as 22 per cent. has, it is stated, been found. The constituent usually present in largest quantity in coal gas is methane or light carburetted hydrogen (40 to 45 per cent. or more). Methane, even when present in air in quantity sufficient to form an explosive mixture (5½ per cent. or over), appears to exert little or no toxic action. Its presence in air, however, is a source of danger to life from the risk of an explosion, which may cause mechanical injury or result in poisoning by carbon dioxide.

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exhales an offensive and dark-coloured engorgement of the stress on the pre-membrane of the phuretted hydrogen cold affusions, still chlorine, as in hydrogen is readily and by its blackening paper moistened with solution of lead acetate. Sulphides—those of the heavy metals excepted—are decomposed by dilute acids, sulphuretted hydrogen being set free.

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creeping sensations, followed by irritability and excitement of the
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 mental debility,
 The "Poison-
 doses in 1914

Peripheral Poisons.

These especially act on the motor nerve terminals end-plates. There is no recorded instance of poisoning by them in India except by cocaine, see p. 621.

Conium.—*Conium maculatum*, or Spotted Hemlock, N.O. *Umbelliferae*; *Shoukran* (Arab.), *Kirdamana* (Ba.).—This is a common plant in Europe and temperate Asia. The whole plant has a 'mousey' foetid odour and is poisonous, the leaves and fruit are official B.P. and I.P. It was the Athenian State-poison by which Socrates died. Cases of poisoning by conium are somewhat rare.

Falck¹ found seventeen recorded in medical literature, of which fourteen were accidental, chiefly from the plant being mistaken for parsley or some other harmless herb. One case is recorded of a child, who died, poisoned by conium, from blowing whistles made of conium

odour A

convulsive twitchings. Consciousness remains until asphyxia sets in. Death occurs rapidly, by asphyxia due to paralysis of respiration, usually in one to four hours. The medicinal dose of the powdered leaves is two to eight grams, and of the tincture of the fruit—strength 1 to 8—

¹ Blyth, *Poisons*, p. 253.

20 to 60 minims. According to Woodman and Tidy, one drop of the alkaloid conia may be regarded as a poisonous dose. Treatment.—General, as for spinal poisons. *Post mortem*.—As in death by apnœa.

test for conia. "If dropped into a solution of alloxan, the latter is coloured after a few minutes, and intense purple red and white needle-shaped crystals are separated, which dissolve in cold potash-lye into a beautiful purple blue." Conia coagulates albumen, and gives an amorphous precipitate with mercuric chloride solution—these characters distinguish it chemically from nicotine (see p. 663).

Curari, or Wourali.—This substance, also called *Urari* or *Tikunas*, is a black resinoid mass, almost wholly soluble in water, used by the South American Indians as an arrow-poison. It is believed to be an extract from a species of *Strychnos*, probably *S. toxifera*, mixed with other matters. When swallowed, it usually causes no symptoms of poisoning. Introduced into a wound, it acts like conia, paralysing the motor nerves, and irritation. It contains an alk chloro-form, and giving a

Curari was one of the poisons arranged to be used in a fanatical plot to poison the Prime Minister, Lloyd George, in 1917, and the intention was to smear it over a protruding nail in the sole of his boot—to act like a serpent's tooth in introducing the poison hypodermically.

The following alkaloids are similar in action to conia and curari—Sparteine, a liquid volatile alkaloid, contained in common broom *Staphisagrace*, one of the alkaloids contained in *stavesacre* (see p. 539), and Methylstrychnia, Methylbrucia, and Methylthebaia, alkaloids obtained from respectively strychnia, brucia, and thebaia, by the substitution of methyl for hydrogen. It may be noted that this substitution, in the case of the alkaloids just mentioned, converts central into peripheral spinal poisons. In the case of conia, a similar substitution converts a peripheral into central spinal poison (see Methyl-conia, pp. 661 and 700).

The Somalis on the East Coast of Africa prepare for hunting and war a paralysing arrow-poison from the extract of the root of '*Oubain*,' a tree allied to the *Carissa schimperii*. The term would seem to be used perhaps in a general sense, for one form of *Oubain* brought from the Harinassa country by Dr. Macpherson consisted of an extract from the wood and leaves of *Acolasthera schimperii*, and it also proved to be a most virulent paralysing poison of the motor nerve-terminals, like that obtained from an altogether different genus.

APPENDICES.

I

QUESTIONS FOR MEDICAL WITNESSES.

(From Departmental Circulars of 1st February, 1864;
4th March, 1892.)

WHEN a case arises requiring medical opinion, the police officer should forward the subject to the medical officer,¹ with such a general description of what is known of the case that the attention of the medical officer may be turned in the right direction. A printed form is provided for the purpose, and should always be used. The reference may be made in English or in the vernacular, as the case may be.

2. The result of the medical officer's examination, together with his opinion on the case, will be entered in that part of the printed form provided for the purpose, and the form so filled up will be returned to the police.

3. The police officer, having received the report of the medical officer, will send up the case according to rule to the magistrate, sending with the *chalan* the form containing the reference to the medical officer and his reply thereto. On the list of witnesses will appear the name of the medical officer.

4. The only use of the medical officer's report will be to assist the police in getting up the case, to refresh the memory of the medical officer at the time of giving his deposition, and to aid the judicial officer in framing his queries. It cannot be admitted as evidence (except under clause (2), s. 32 of the Evidence Act); nor is it sufficient to read it over to the medical officer and swear him to the truth of it; his deposition must be recorded *de novo* and at length in the presence of the accused.

¹ Circular 55.—Where a post mortem examination is necessary, the corpse will be forwarded to the nearest civil surgeon or other medical officer appointed in this behalf by the Local Government under s. 174, Code of Criminal Procedure.

The magistrate should therefore look into the case and make himself acquainted with its particular features before the medical officer enters the court, in order that the proper questions may be asked.

5 Care should always be taken to record the medical evidence so fully and intelligently as to render a second examination of the witness by another court unnecessary.

6 With a view of assisting magistrates in the task of asking suitable questions, a list of questions which suggest themselves in each class of refer at the time

7. Before the is to be fully interpreted to the accused, who is to be allowed to cross-examine. In order to ensure that the medical officer's deposition may in all cases be admissible under s. 509, Criminal Procedure Code, the magistrate must sign at the foot of it a certificate in the following form:—

"The foregoing deposition was taken in the presence of the accused, who had an opportunity of cross-examining the witness. The deposition was explained to the accused, and was attested by me in his presence."

This is, of course, specially necessary when the deposition is taken in an inquiry preparatory to commitment to the sessions.

8. Whenever a medical officer is examined as to the result of his examination of any person, corpse or substance, evidence should always be taken to prove that the person, corpse, or substance examined by him, and to the examination of which he testifies, is the person, corpse, or substance in question in the case

by him with the person in question in the case, and beyond doubt by actual identification in court if the person is able to be present, and if not, by the evidence of the person who conducted him to the medical officer.

10. If in any particular case the evidence of a medical witness is not to be had, the details, such as fact of death, symptoms, appearances, wounds, must be made out as correctly as possible from the evidence of non-professional eye-witnesses. The courts cannot assume any such facts from mere reports, not admissible as evidence. Police officers can always be put into the witness box to bear witness to what they saw.

A.

Questions which may be put to a medical witness in a fatal case of suspected **Poisoning**, after *post mortem* examination of the body

1. Did you examine the body of —, late a resident of —, and, if so, what did you observe?

2. What do you consider to have been the cause of death? State your reasons.

3. Did you find any external marks of violence on the body? If so, describe them.

4. Did you observe any unusual appearances on further examination of the body? If so, describe them.

5. To what do you attribute these appearances—to disease, poison, or other cause?

6. If to poison, then to what class of poisons?

7. Have you formed an opinion as to what particular poison was used?

8. Did you find any morbid appearances in the body besides those which are usually found in cases of poisoning by —? If so, describe them.

9. Do you know of any disease in which the *post mortem* appearances resemble those which you observed in this case?

10. In what respect do the *post mortem* appearances of that disease differ from those which you observed in the present case?

11. What are the symptoms of that disease in the living?

12. Are there any *post mortem* appearances usual in cases of poisoning by —, but which you did not discover in this instance?

13. Might not the appearances you mention have been the result of spontaneous changes in the stomach after death?

14. Was the state of the stomach and bowels compatible or incompatible with vomiting and purging?

15. What are the usual symptoms of poisoning by —?

16. What is the usual interval between the time of taking the poison and the commencement of the symptoms?

17. In what time does — generally prove fatal?

18. Did you send the contents of the stomach and bowels (or other matters) to the chemical examiner?

19. Were the contents of the stomach (or other matters) sealed up in your presence immediately on removal from the body?

20. Describe the vessel in which they were sealed up; and what impression did the seal bear?

21. Have you received a reply from the chemical examiner? If so, is the report now produced that which you received?

22. (If a female adult). What was the state of the uterus?

B.

Questions that may be put to non-professional witnesses in a
Case of Suspected Poisoning.

1. Did you know —, late a resident of —? If so, did you see him during his last illness and previously?

2. What were the symptoms from which he suffered?

3. .

4. .

5. . of eating
or drink

(If death occurred.) 6. What was the interval between the commencement of the symptoms and death?

7. What did the last meal consist of?

8. Did any one partake of this meal with —?

9. Were any of them affected in the same way?

10. Had — ever suffered from a similar attack before?

If any of the following symptoms have been omitted in answer to question 1, special questions may be asked regarding them as follows.

11. Did vomiting occur?

12. Was there any purging?

13. Was there any pain in the stomach?

14. Was — very thirsty?

15. Did he become faint?

16. Did he complain of headache or giddiness?

17. Did he appear to have lost the use of his limbs?

18. Did he sleep heavily?

19. Had he any delirium?

20. .

21. . .

22. .

This is with
to Nux Vomica.

the convulsions?

This is with reference
to Arsenic.

23. Did he complain of burning or tingling in the mouth and throat, or of numbness and tingling in the limbs?

C

Questions which may be put to a medical witness in a case of supposed **Death by Wounds or Blows** after *post mortem* examination of the body

1. Did you examine the body of —, late a resident in the —, and if so, what did you observe?
2. What do you consider to have been the cause of death? State your reasons
3. Did you find any external marks of violence on the body? If so, describe them
4. Are you of opinion that these injuries were inflicted before or after death? Give your reasons
5. Did you examine the body internally? Describe any unnatural appearance which you observed.
6. You say that in your opinion — was the cause of death, in what immediate way did it prove fatal?
7. Did you find any appearance of disease in the body?
8. If so, do you consider that if the deceased had been free from this disease the injuries would still have proved fatal?
9. Do you believe that the fact of his suffering from this disease lessened his chance of recovery from the injuries sustained?
10. Are these injuries taken collectively (or is any one of them) ordinarily and directly dangerous to life?
11. Have they been caused by manual force or with a weapon?
12. Did you find any foreign body or foreign matter in the wound?
13. By what sort of weapon has the wound been inflicted?
14. Could the injuries have been inflicted by the weapon now before you (No. — Article in evidence)?
15. Could the deceased have walked (so far) or spoken, &c., after the receipt of such an injury?
16. Have you chemically or otherwise examined the stains (on the weapon, clothes, &c.) now before you (No. — Article in Evidence)?
17. Do you believe the stains to be those of blood?
18. What time do you think elapsed between the receipt of the injuries and death?
19. What was the direction of the wound, and can you form an opinion as to the position of the person inflicting such a wound with respect to the person receiving it?

20. Is it possible for such a wound to have been inflicted by any one on his own person?

(In gunshot wounds.) 21. Give the precise direction of the wound.

22. Did the appearances of the wound indicate that the gun had been discharged close to the body or at some distance from it?

23. Did you find any slug, bullet, wadding, &c., in the wound or had ——— made its exit?

24. Do you think it possible that you could have mistaken the aperture of entrance for that of exit?

D.

Questions that may be put to a medical witness in a case of supposed **Infanticide**, after *post mortem* examination of the body.

1. Did you examine the body of a ^{male}_{female} child sent to you by the District Superintendent of Police on the ——— of ——— 19 —, and if so what did you observe?

2. Can you state whether the child was completely born alive, partially born alive, or born dead? State the reasons for your opinion.

3. What do you consider to have been the cause of death? Give your reasons.

4. What do you believe to have been the uterine age of the child? State your reasons.

5. What do you believe to have been the extra-uterine age of the child? Give reasons.

6. Did you find any marks of violence or other unusual appearances externally? If so, describe them accurately.

7. Did you find any morbid or unusual appearances on examination of the body internally? If so, describe them accurately.

8. Do you believe the injuries you observed to have been inflicted before or after death? Give reasons.

9. Can you state how they were inflicted? Give reasons.

10. Do you consider that they were accidental or not? Give reasons.

11. Had the infant respired fully, partially, or not at all?

12. Did you examine the person of ———, the alleged mother of the infant? If so, have you reason to suppose that she was recently delivered of a child? Can you state approximately the date of her delivery? Give reasons.

E.

Questions that may be put to a medical witness in a case of supposed death by **Hanging** or **Strangulation**.

1. Did you examine the body of —, late a resident of —, and, if so, what did you observe?

2. What do you consider to have been the cause of death? State the reasons for your opinion.

3. Did you observe any external marks of violence upon the body?

4. Did you observe any unnatural appearances on examination of the body internally?

5. Was there any rope or other such article round the neck when you saw the body?

6. Can you state whether the mark (or marks) you observed were caused before or after death?

7. By what sort of articles do you consider the deceased to have been hanged (or strangled)?

8. Could the mark you observed have been caused by the rope or other article now before you (No. — Article in Evidence)?

9. Do you think that this rope could have supported the weight of the body?

(If strangulation) 10. Would great violence be necessary to produce the injuries you describe?

F.

Questions that may be put to a medical witness in a case of supposed death by **Drowning**, after *post mortem* examination of the body.

—, late a resident of —,

been the cause of death?

State your reasons.

3. Were there any external marks of violence upon the body? If so, describe them.

4. Describe any unnatural appearances which you observed on further examination of the body.

5. Did you find any foreign matters, such as weeds, straw, etc., in the hair, or clenched in the hands of the deceased, or in the air passages, or attached to any other part of the body?

6. Did you find any water in the stomach?

G.

Questions that may be put to a medical witness in a case of
alleged Rape.

1. Did you examine the person of Mussamut — ? If so, how many days after the alleged rape did you make the examination, and what did you observe ?

2. Did you observe any marks of violence about the vulva or adjacent parts ?

3. Are these injuries such as might have been occasioned by the commission of rape ?

4. Was the hymen ruptured ?

5. Did you observe any further marks of violence upon the person of the woman ?

6. Had she passed the age of puberty ?

N B — This question only to be asked in the case of the rape of a girl of tender years

7. Can you state approximately what her age is ?

8. Did you find her to be a strong, healthy woman, or so weakly as to be unable to resist an attempt at rape ?

9. Did you examine the person of the accused ?

10. Did you observe any marks of violence upon his body ?

11. Was he suffering from any venereal disease ?

12. Did you find the woman suffering from a similar or other venereal disease ?

13. Had a sufficient time elapsed, when you examined the person of the woman, for venereal disease to have made its appearance in case of her having been infected ?

14. Can you state approximately how long the defendant had been suffering from this complaint ?

15. Can you state approximately how long the woman had been suffering from this (venereal) complaint ?

16. Have you examined the stained articles forwarded to you, and now in Court (No. — Article in Evidence) ?

17. What is the result of your examination ?

18. Do you believe that a rape has been committed or not ? State your reasons.

H.

Questions that may be put to a medical witness in cases of
suspected Insanity.

1. Have you examined — ?

2. Have you done so on several different occasions, so as to

preclude the possibility of your examinations having been made during lucid intervals of insanity?

3. Do you consider him to be capable of managing himself and his personal affairs?

4. Do you consider him to be of *unsound mind*; in other words, *intellectually insane*?

5. If so, do you consider his mental disorder to be complete or partial?

6. Do you think he understands the obligation of an oath?

7. Do you consider him, in his present condition, competent to give evidence in a Court of Law?

8. Do you consider that he is capable of pleading to the offence of which he now stands accused?

9. Do you happen to know how he was treated by his friends (whether as a lunatic, an imbecile, or otherwise) prior to the present investigation and the occurrences that have led to it?

10. What, as far as you can ascertain, were the general characteristics of his previous disposition?

11. Does he appear to have had any *previous* attacks of insanity?

12. Is he subject to *insane delusions*?

13. If so, what is the general character of these? Are they harmless or dangerous? How do they manifest themselves?

14. Might such delusion or delusions have led to the criminal act of which he is accused?

15. Can you discover the *cause* of his reason having become affected? In your opinion, was it *congenital* or *accidental*?

16. If the latter, does it appear to have come on suddenly or by slow degrees?

17. Have you any reason for believing that his insanity is of *hereditary* origin? If so, please to specify the grounds for such an opinion, and all the particulars bearing on it— as to the insane parents or relatives of the accused, the exciting cause of his attack; his age when it set in; and the type which it assumed.

18. Have you any reason to suspect that he is, in any degree, *fringing* insanity? If so, what are the grounds for this belief?

19. Is it possible, in your opinion, that his insanity may have followed the actual commission of his offence, or been caused by it?

20. Have you any reason to suppose that the offence could have been committed during a *lucid interval*, during which he could be held responsible for his act? If so, what appears to have been the duration of such lucid interval? Or, on the

contrary, do you believe his condition to have been such altogether to absolve him from legal responsibility?

21. Does he now display any signs of homicidal or of suicidal mania, or has he ever done so to your knowledge?

22. Do you consider it absolutely necessary, from his present condition, that he should be confined in a lunatic asylum? again:

23. Do you think that judicious and unremitting supervision out of an asylum might be sufficient to prevent him from endangering his own life, or property of others?

I.

Questions that may be put to a medical witness in a case of alleged **Causing Miscarriage** (ss. 312-316, I. P. C.).

1. Did you examine the person of Mussamut —? If so, when? and what did you observe?

2. Are you of opinion that a miscarriage has occurred or not? Give your reasons.

3. In what mode do you consider the miscarriage to have been produced—whether by violence per vaginam, or by external violence, or by the use of irritants internally? Give your reasons.

4. It is alleged that a drug called — was used; state the symptoms and effects which the administration of this drug would produce. Do you consider that it would produce miscarriage?

5. Can you state whether the woman was quick with child when the miscarriage was produced? State your reasons.

6. Did you see the foetus? If so, at what period of gestation do you consider the woman to have arrived?

J.

Questions that may be put to a medical witness in a case of **Grievous Hurt**.

1. Have you examined —? If so, state what you observed.

2. Describe carefully the marks of violence which you observed.

3. In what way do you consider the injuries to have been inflicted? If by a weapon, what sort of a weapon do you think was used?

4. Do you consider that the injuries inflicted could have been caused by the weapon now shown to you (No — Article in Evidence)?

5. What was the direction of the wound? and can you form an opinion as to the position of the person inflicting such a wound, with respect to the person receiving it?

6. Is it possible for such a wound to have been inflicted by any one on his own person? Give your reasons.

The magistrate in putting this question will show the I. P. Code to the witness; or the magistrate may vary the form of the question so as to elicit the required information without calling the witness's attention to the I. P. Code.

7. Do you consider that the injuries inflicted constitute any of the grievous hurts defined in s. 320 of the Indian Penal Code? If so, which of them? Give your reasons.

8. Do you consider that the person injured is now out of danger?

9. It is alleged that the injuries were caused by—. Could they have been caused in the manner indicated?

10. Have you chemically or otherwise examined the stains (on the weapon, clothes, etc.) now before you (No — Article in Evidence)?

N.B.—In case of the injuries being gunshot wounds, questions 21 to 24 under the head of No. III. (death by wounds) may be put to the witness.

11. Do you believe the stains to be those of blood?

Police Code No. 189.

II.

Legal Definitions of an "OFFENCE," and its Detailed PUNISHMENT.

In India, "offences" are defined, and the punishment awardable for each offence limited, by the *Indian Penal Code* (Act XLV. of 1860), certain general provisions of which may be here considered.

1. 1. 1.

I. By a child under the age of seven (s. 300.)

II By a child between the ages of seven and twelve (not as in England between the ages of seven and fourteen), "who has not attained

sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion." (S. 83.)

III. By a person of unsound mind, "if by reason of unsoundness of mind the doer of the act is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law." (S. 81.)¹

IV. By an intoxicated person, but only, provided,

(1) "the thing which intoxicated him was administered to him without his knowledge or against his will;" and

(2) when by reason of the intoxication so induced, the intoxicated

certain conditions are complied with, the chief of which are—

1. That the act must not be intended to cause death. (S. 83)

2. That the act must not of itself be an offence independently of any harm it may cause to the person on whose body the act is done; e.g. causing miscarriage, except for the purpose of saving the life of the mother. (S. 91.)²

3. That the act is done with the consent of the sufferer, such consent—

a. Not being known to the doer of the act to have been given under

2. The circumstances are such that it is impossible for him to signify his consent, and he has no person in lawful charge of him from whom it is possible to obtain consent, in time for the thing to be done with benefit. (S. 92.)

of any grievous disease or infirmity. (S. 89.)

B. An offence may be committed by illegal omission (s. 32); thus, a woman may commit murder by intentionally omitting to supply her infant with food.³

commission of the offence, shall, where no express provision is made by this Code for the punishment of such attempt, be punished with transportation or imprisonment of any description provided for the offence, for

¹ See also 'Insanity,' p. 314 f.; also p. 384.

² See also 'Causing Miscarriage,' p. 306 f.

³ See 'Wounds,' p. 103 f.

⁴ See 'Infanticide,' p. 319 f.

a term of transportation or imprisonment which may extend to one-half of the longest term provided for that offence, or with such fine as is provided for the offence, or with both." ¹

D. The punishments awardable for offences are defined by s. 53 of the *Penal Code* to be: 1. Death. 2. Transportation. 3. Penal servitude. 4. Imprisonment, which may be either (a) Rigorous, that is, with hard labour; or (b) Simple, that is, without hard labour. 5. Forfeiture of property. 6. Fine. And under Act VI. of 1864, whipping may be awarded for certain offences. The chief medico-legal points in connection with these punishments are:—

I. Death.—This (see s. 303 of Act X. of 1862, the *Code of Criminal Procedure*) must be by hanging. Pregnancy may be pleaded in bar of execution. "If a woman sentenced to death be found to be pregnant, the High Court shall order the execution of the sentence to be postponed, and may commute the sentence to transportation for life." (*C. P. C.*, s. 382) In India the question by whom the existence of the law, try

II. Hard Labour.—A medical man may be called on to determine whether a prisoner is in a fit state of health or not to perform certain descriptions of labour, in such a case, the chief points for inquiry would be as to—

1 The prisoner's general health.

2 His freedom or otherwise from cardiac disease, aneurism, or grave

In many cases labour to be performed may be reduced to foot tons by Haughton's formula, which may be stated as follows. Add together the body-weight of the individual (in pounds), and the weight (in pounds) carried by him, multiply this by the height (in feet) ascended, plus one-twentieth of the horizontal distance (in feet—1 mile = 5280 feet) travelled, and divide the product by 2240

I.

s. 394.)

the sentence cannot at some future period be inflicted. (*C. P. C.*, s. 394.)

¹ See also 'Causing Miscarriage,' p. 306 f.

² See 'Pregnancy,' p. 266.

III.

(This is cited on p. 90.)

NECROPSY or POST-MORTEM EXAMINATION
DIRECTIONS.

THE order of examination should always be that here given, unless special reasons of the nature before indicated exist for departure therefrom. Incisions made through the skin for the purpose of opening cavities should avoid already existing external wounds. If on dissection any internal injury is found likely to have resulted from external violence, careful examination should be made—if this has not already been done—for signs of violence in the tissues between the seat of injury and the surface of the body; and for marks of violence on the surface of the body over the seat of injury. Any unusual appearances found, in addition to those already mentioned, should be recorded.

I—THE HEAD.

The internal examination of the body should commence with dissection of this cavity:—(a) in cases where the cause of death is doubtful, and (b) when it is suspected that death has been due to head injury, or has occurred by coma.

Procedure.

1. Make an incision through the integuments from ear to ear over the vertex and reflect the scalp, one flap forwards, the other backwards.

2 Saw through the skull by a circular cut at the level of about an inch above the orbits in front, and of the occipital protuberance behind, detaching the skull cap without using the chisel. Raise the skull-cap from before backwards, separating the dura mater from it.

fully and removed with the skull-cap.

Appearances to be looked for and recorded.

(a) Extravasations of blood in or under the scalp, their situation and extent. (b) Injuries to the bones of the skull-cap visible externally, viz separation of sutures, fractures, or indentations; their situation, extent, and direction (see 2 b, below).

(a) Unusual thinness of the skull bones. (b) Complete 1 b, above, by examining inner surface of skull-cap. (c) Fullness (or the reverse) of the longitudinal sinus. (d) Condition of the membranes of the brain, e.g. amount of adhesion, if any, of the dura mater to the skull cap, presence of congestion or signs of disease. (e) Extravasations of blood between the skull-cap and the brain, their situation and extent.

Procedure.

Appearances to be looked for and recorded.

4. Remove the brain carefully, place it base downwards, and proceed to slice it horizontally from above.

(a) Extravasations at the base of the skull, their situation and extent. (b) Volume of any serous fluid found within the skull or ventricles of the brain. (c) Weight, colour, and consistence of the brain (and in immature infants its condition of development, pp. 282 f.) (d) Apoplectic effusions within the substance of the brain, their situation and extent. (e) Freedom or otherwise from disease of the coats of the cerebral arteries.

5. Strip off the dura mater from interior of the skull.

(a) Fractures of the base of lateral portions of the skull, their situation, extent, and direction, and thickness of the bones at the seat of the fracture. (b) In infants, presence of air in the cavity of the tympanum.

6. Examine the upper portion of the spinal cord through the foramen magnum.

If any signs of injury to the cono- or upper cervical vertebrae are found, proceed at once to IV, returning subsequently to II.

II.—THE THORAX (including preliminary examination of the abdominal cavity).

The internal examination of the body should commence here, in cases where death appears to have been due to chest injury, or to have occurred by asphyxia. Also when there is reason to believe that the cause of death is connected with the contents of the abdomen. In this last case, after II 1 proceed to III (see *N.B.* below).

1. Make a long incision from a little above the sternum down to the pubes, reflect the integuments on either side, laying open the abdominal cavity but not the cavity of the thorax. In infants take care to carry the incision a little to the left of the umbilicus.

(a) Position, colour, and general appearance of the exposed viscera. (b) Presence of abnormal contents, e.g. blood, products of inflammation, or tumours. (c) Determine with the hand (especially in new-born infants) the position of the diaphragm, noting whether the upper level of this is between the fifth and sixth ribs (see Chap. XVI.), or higher. *N.B.*—Should this preliminary examination indicate, or there be reason to believe, that the cause of death is connected with the contents of the abdomen, proceed at once to III, subsequently returning to II. 2.

Procedure.

Appearances to be looked for and recorded.

2. Complete the reflection of the integuments over the thorax to a point beyond the junction of the cartilages of the ribs

(a) Extravasations of blood or signs of bruising in the integuments of the front of the chest, their situation, and extent. (b) Fractures of the anterior portions of the ribs, their situation, and the direction in which the fractured ends appear to have been driven (see also II., 9 c).

ribs a little outside the cartilages

from the underlying large veins flows into the pleural cavity. When the cartilages have been cut forcibly draw the sternum upwards till it fractures without injuring the veins.

(a) Volume of the lungs, *i.e.* whether projecting out of the chest (indicating emphysema); or expanded and nearly covering the pericardium, but not projecting; or collapsed, exposing the pericardium. (b) Colour of the lungs; in infants, whether dark red or bright red. (c) Fluid in the pleural cavities, nature and volume. (d) Adhesions of the lungs. (e) Condition of the thymus gland. (f) Tumours in the thorax.

4. Open the pericardium.

(a) Condition of the pericardium; nature and volume of any fluid present therein. (b) Size, colour, and consistence of the heart and condition of fullness of the coronary vessels.

5. Without removing the heart from the body, open its cavities in the following order: (1) R. ventricle. (2) R. auricle; (3) L. auricle. (4) L. ventricle. Incision required: (1) Along the right border of the heart, beginning close to the base and ending short of the apex. (2) Begins midway between the entrances of the venæ cavæ, and ends just in front of the base. (3) Begins at the left superior pulmonary vein, and ends just in front of the base, short of the coronary vein. (4) Begins behind the base and ends short of the apex.

Note, as each cavity is opened, the amount and condition of its contents.

6. Remove the lungs and heart together. *N.B.*—In cases where it is suspected that death has been due to injury to the neck, and in cases where the condition of or presence of foreign matters in the

(a) Presence on the surface of the lungs of Tardieu's spots, or patches of emphysema (see Strangulation and suffocation). (b) In new born infants, note if inflated air-vesicles are visible on the surface of the

Procedure.

Appearances to be looked for and recorded.

gullet or air-passages is likely to be of importance, proceed after 5 or 10, returning to 6 *et seq.* afterwards.

7. Separate the heart, and test the condition of the arterial openings by pouring in water.

8. Make long incisions into each lung, and, if necessary, follow the branches of the bronchial tubes and pulmonary artery by dividing them with scissors.

9. Previous to opening the descending aorta, tie two ligatures round the œsophagus near the diaphragm, divide the œsophagus between them and dissect it out of the way.

10. Prolong the incision upwards to the chin, reflect the skin as far back as possible, separate the soft parts from the inside of the lower jaw, cutting close to the bone. Pull the tongue forwards below the chin, and carry the dissection backwards, separating the pharynx and œsophagus with the larynx and trachea from the spine. Open in succession the larynx, trachea, and œsophagus.

crepitate, or show signs of disease.

(a) Condition of the cardiac valves, tufts of fibrin on their edges, etc. (b) Livid patches on the endocardium (see Arsenic). (c) Condition of the heart tissue. (d) In new-born infants, condition of the foramen ovale. (e) Conditions of the portions of the large vessels remaining attached to the heart.

(a) General characters of the lung tissue. (b) Disease of the lungs. (c) Apoplectic effusions into the lung substance (see Strangulation). (d) Condition of the bronchial tubes, nature and quantity of foreign matters present therein (see Drowning). (e) Condition of the branches of the pulmonary artery, noting any obstruction.

(a) In newborn infants, note the condition of the ductus arteriosus. (b) Examine the aorta for atheroma and aneurism. (c) Complete the examination of the ribs for fractures.

(a) Foreign bodies, marks of corrosion, etc., in the larynx, trachea, and œsophagus. (b) Examine the large vessels of the neck for injury, obstruction, etc., opening them carefully. (c) Ascertain the condition of the cervical vertebrae.

III.—THE ABDOMEN

In infants the condition of the umbilical vessels, and of their continuations within the abdomen, should, so far as can be done without removal of any of the abdominal viscera, now

be ascertained, completing the examination after the remaining portions become exposed by removal of the viscera.

In all cases examine first generally, and without further dissection, the abdominal viscera *in situ*. Should this examination show, or should there be reason to believe, that the cause of death is connected with any particular organ, the further examination should commence with the organ or organs concerned. Thus in cases of poisoning the further examination should commence with the stomach and intestines. Each viscus should be carefully examined *in situ* previous to its removal for further examination, noting particularly any enlargement or unusual appearance and any wound or sign of injury. If a wound be present, its precise situation, direction, and appearance should be described, and it should be noted whether or not any blood is effused in its neighbourhood. The general consistence of the injured viscus should also be noted. Each viscus is then to be removed, and, after removal, further examined, as below.

1. The liver.—Note its weight and appearance on section. This may be (a) uniform dark brown = *normal*, or (b) either uniform dark red, the cut surface exuding blood pretty freely; or of a nutmeg appearance, &c. in some places dark red, in others buff or yellow = *congestion*; or (c) texture dense and tough, surface irregular = *cirrhosis*; or (d) in places soft pale yellow, and greasy = *fatty*; or (e) uniformly pale yellow, and reduced in size = *yellow atrophy*; or (f) enlarged and heavy, consistence doughy, cut surface greyish and glistening or semi-translucent in appearance = *amyloid* or *lardaceous*. Note presence of abscesses or tumours. Note also the condition of the gall-bladder, and the nature of its contents. If there be any reason to suspect death from poison, preserve for analysis a large portion of the liver, at least one pound in weight.

2. The spleen.—Note its size, weight, and appearance on section. If death has been due to rupture of this organ, it is of special importance to note its consistence, and whether or not any signs of injury are present on the surface of the body over it, or in the tissues lying between it and the surface of the body.

3 The kidneys.—Note in regard to each its weight, and whether or not the . . .
ing at the convex . . .
as the pelvis, and note any signs of inflammation . . .
membrane be present. Note the condition of the cut surface.

Congestion accompanied by softening and enlargement, or pallor similarly accompanied, indicate inflammation respectively in the early and later stage. Again, the capsule may be adherent, the viscus reduced in size, and its section granular

4. **The pelvic organs.**—Tie two ligatures round the lower part of the larger intestine a little above the rectum, and divide the gut between them. Open the urinary bladder *in situ* and determine its contents, preserving any urine found for subsequent analysis. In male infants, note the position of the testicles. Then, having examined each organ *in situ*, remove the whole of the pelvic organs together, and complete the examination of the bladder, ureters, and urethra, noting in males the size of the prostate and the condition of the testicles. Examine the rectum, noting specially in infants the presence or absence of meconium.

In females, examine the generative organs as follows —

(a) **The vagina.**—This is to be opened first and examined for marks of injury and presence of foreign bodies, preserving any matters found for analysis. Its colour, the presence or absence of rugæ, and the condition of the hymen are also to be noted.

(b) **The uterus.**—Measure externally its length and greatest breadth. Take its weight. Then open it by an incision from fundus to cervix, and note the dimensions of its cavity and the thickness of its walls (see 'Abortion,' p. 306 ff). Note the nature of its contents, if any, and if a fetus be present determine its age (see table, p. 286). Record the condition and colour of the lining membrane and muscular substance, presence of internal injuries, or of morbid growths.

(c) **The ovaries.**—Note in regard to these their size and external appearance, and after section examine for signs of disease and for true and false corpora lutea (see p. 317).

5. **The stomach.**—Before removing this viscus tie two ligatures round the duodenum close to the stomach, and divide the gut between these ligatures. (If the abdominal cavity is dissected before the thorax, a similar procedure must, before removing the stomach, be adopted with the œsophagus (see II., 9).) In infants, before opening the stomach, note if any air appears to be contained in it (see p. 331). Then place

the stomach in a clean jar or photographic developing dish and open it along its lesser curvature, collecting its contents in the vessel. Note the volume of the fluid contained in the stomach, its general appearance, the character of any matters suspended in it, and any peculiar odour possessed by it. In infants, examine the contents of the stomach for the presence of milk, food, etc. (see 'Infanticide,' p. 331). *If there is any reason to*
of the stomach for analy
 the mucous membrane, &
 ing particles of poison. . . .
 be picked off with a pair of forceps and separately preserved for analysis.

6 **The intestines.**—These should be removed like the stomach, and, after removal, should be laid open along their whole length, preserving, in cases of suspected poisoning, their contents for analysis, with precautions similar to those observed in preserving the contents of the stomach. In the case of infants note if meconium be present, and its position. Note the condition of the mucous membrane, presence of any erosions, ulcers, or perforations, and the condition of the agminate and solitary glands.

N.B.—After completing the dissection of the abdomen, proceed to the dissection of the thorax, should this cavity not have been already dissected (see II., 2).

IV.—THE SPINE AND SPINAL CORD.

This should be examined in all cases where it is likely to have been injured, or where symptoms of irritation or inflammation have been present or tetanus or poisoning by strychnine, etc., suspected. It should always be the final object examined, so that this rough operation may not injure or obscure the condition of other cavities and organs. Procedure: divide the integuments down to the bone by an incision in the middle line along the whole length of the epinal column; reflect the integuments on either side and cut away the muscles from the arches of the vertebrae. In carrying out this dissection, note any extravasations of the blood in the tissues over the spine and any fracture of the bones which may be exposed. Then saw through the vertebral arches on either side and remove the detached portions of bone. Examine the outer surface of the exposed dura mater, then slit it open carefully along its whole length, and examine the exposed portion of the pia mater &

situ. Next pass the finger gently down the cord, noting its consistence; then remove the cord from the body and complete its examination, making for this purpose transverse incisions through it in several places. Finally, remove the dura mater from the interior of the spinal canal, and complete the examination of the vertebre for fractures.

V.—THE KNEE JOINT.

In new-born infants this joint should be opened by a transverse incision in front, the lower end of the femur pushed out through the wound, and the cartilage at the end of the bone sliced transversely in fine slices until a pink spot appears in the cut surface; very fine slices are then to be made and the greatest diameter of the bony nucleus ascertained (see pp. 48 and 286).

[The instruments used in the *post-mortem* examination should after washing be sterilized by heat. This may be done by dipping the blade into benzine and then applying a light, the flame being sufficient to sterilize the metal.]

WEIGHTS OF VISCERA.

The weights of the viscera should be ascertained if possible. The table¹ below shows the average weights of the chief viscera of adult natives of Bengal and Bihar who have died in gaols of disease.

Organ	No of cases		Average weight.		Highest		Lowest	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Liver	333	68	4½	37½	103	62	13	16
Spleen	314	91	10½	6½	64	49	1	1
Lung, R.	224	49	16	9½	52	20	5	6
" L.	224	49	14½	9½	43	17	5	4
Heart	238	46	7½	6	20	9	4	4
Kidney, R.	246	68	8½	3½	8	6	2	1
" L.	246	68	3½	3½	8	6	2	1
Brain	143	7	33	37	56	42	33	26

Average height 5 ft. 3 in. Average weight 110 lbs. Based on 28,000 cases.—*I. M. G.*, Oct., 1897.

¹ Compiled by Major W. J. Buchanan and Captain Maddox, *I.M.S.*, *Ind. Med. Gaz.*, June, 1902.

The average weight for Europeans is:—

IN ADULT EUROPEANS (according to Tidy).

Organ	Male.	Female.
	oz.	oz.
Brain	49½	44
Lungs (together)	45	32
Heart (usually about, in inches, 5 x 3½ x 2½)	9½	8½
Stomach	4½	A little less than 4½
Liver	50—60	45—55
Spleen	5—7	5—7
Pancreas	2½—3½	2½—3½
Kidneys (together)	9	8½

In the female the brain and lungs are lighter than in males by 5½ and 13 oz. respectively.

IV.

MEDICO-LEGAL REPORT.—FORM.

The following documents should be sent to the Chemical Examiner in connection with medico-legal cases of suspected crime.

HUMAN POISONING.

I. Fatal Cases.—By post.—1. *Post Mortem* Report (No. 1).

NOTE.—Information on the following toxicologically important points should invariably be supplied:—(a) date and hour of onset of symptoms; (b) date and hour of patient's death; (c) in cases where the body has been exhumed, the dates of burial and of exhumation should be mentioned. In all cases the entire stomach and contents, with portions of liver and kidney, should be sent. In *datura* cases, portions of the small intestine should also be sent.

2. Statement of symptoms supplied by the police to the forwarding medical officer.

3. Note of treatment, if any, adopted in the case (by the medical officer, police, or patient's friends).

4. Police reports (not vernacular) sent with the case to the forwarding medical officer.

5. Nature of the preservative used. (Rectified spirits to be

used except in suspected alcohol, phosphorus, or carbolic acid cases.)

6. The seal should, if possible, be a private one, and the same seal should be used throughout.

Under the cover of the box containing the articles for analysis :

Memo. stating (a) deceased's name and (b) number and date of *post mortem* report.

II. Non-fatal Cases.—By post.—Medico-legal Form No. II., laying stress on the following:—

- (a) Symptoms observed by the medical officer or reported by the police.
- (b) Note of treatment adopted (if any).
- (c) Police reports (not vernacular) forwarded with the case to the forwarding medical officer.
- (d) Nature of the preservative, if any, that has been used.

Under the cover of the box containing the articles for analysis :

Memo. stating number and date of medico-legal form used and name of case.

ABORTION CASES

Fatal—Same as in fatal human poisoning cases, but, in addition, the uterus should invariably be sent, along with any foreign bodies found in the genital tract

Non-fatal.—Same as in non-fatal human poisoning cases, but, in addition, care should be taken to forward any foreign bodies expelled or removed from the vagina or uterus

BLOOD CASES.

In blood and semen cases particular care must be taken to forward the magistrate's certificate permitting the removal of exhibits for chemical examination along with the exhibits.

1. Medico-legal Form No. II.

2. Memo with name of case and number and date of medico-legal form used to be enclosed along with the articles for examination.

them, and the string should be sealed.

SEMEN CASES.

1, 2, and 3. As in blood cases.

4. Care should be taken that the cloth be not folded at the stained portion. The stain should be kept quite flat. The stained places should be protected by a thin layer of cotton wool on each surface, as pressure may suffice to crush the spermatozoa beyond the possibility of recognition under the microscope.

5. Where possible, slides should be prepared from vaginal mucus, etc., in cases of rape or unnatural offence.

CATTLE CASES.

(Fatal and Non-fatal.)

By post.—1. Medico-legal Form No. II.

2. A sample of the preservative used in the case. (A saturated solution of common salt to be used for cattle cases.)

Under the cover of the box containing the articles for analysis:

Number and date of medico-legal form used and name of case.

NOTE I.—In sui-poisoning cases the punctured portion should always be searched for the needle or its fragments or any other foreign substance. Such articles should be packed separately.

NOTE II.—It is very important that portions of stomach and of liver be sent in all cases.

MISCELLANEOUS.

Attention is also directed to the following points:—

1. Bottles of sufficient size must be used. If viscera are tightly packed into bottles and insufficient space left for the preservative fluid, they will necessarily arrive in a decomposed and probably useless state. The fluid should have free access to every part of the specimen, which should, in fact, almost float in the fluid, so that no matter in what position the bottle may be placed, the viscera will always be covered by the fluid.

2. Under no circumstances should viscera from different cases be included in the same parcel.

3. If two or more examinations have to be made on the same occasion, the medical officer should complete one and label and seal the articles connected with it before commencing a second examination, otherwise there is a risk of the viscera, etc., of one case getting mixed with those of another.

4. In cases where the police send a closed parcel through a medical officer, and the latter has no occasion to open it in transmission, the parcel should be placed in a second cloth cover, and the memo. referred to in the above instructions should be placed under this fresh cover. This procedure is necessary in order to prevent cases getting mixed up on receipt in the chemical examiner's office.

5. The impression of the seal attached to forwarding letter should be protected on both sides by a thin layer of cotton-wool to prevent the wax being powdered in transit.

6. The labelling and numbering of articles should not be in the vernacular, but in English.

20, B. C. M. D.

V.

HYPOSTASIS v. INJURY.

(Refer, p 84.)

Bain Case.—Hypostasis mistaken for injury.—This was a celebrated

dependent surface of the body of a livid dusky colour in diamond shaped patches, bounded by white lines corresponding to the ropes of the *charpoy* on which the body lay. He considered these marks due to suffocation. Internally he found disease of the mitral valves; the base of the left lung consolidated but containing two abscesses with thickened walls. There was recent pleurisy of both sides. He looked upon these evidences of disease as a satisfactory cause of death. He found no signs of injury.

The body was then buried in a shallow damp grave. Four days later the body was exhumed. On the *sixth day after death*, a second autopsy was performed by Lt.-Col. Borah, I.M.S., who reported that the body was decomposing that rigor mortis was present!!! that he found the abscesses of the lung to contain a thick, creamy, soap-like substance. (This portion of the lung has been preserved in formaline.) That all cusps of the mitral valve were much thickened; the heart hypertrophied that the brain was decomposing and contained about half a drachm of reddish serum in "both third ventricles" (*sic*), that the lateral fourth and fifth ventricles were normal. The marks on the dorsum were in his opinion contusions due to opinion death was due to *stirrup leather*. He was of in a consolidated patch of have caused death.

He relied on the "colour of the serum in both third ventricles" as satisfactory evidence of shock!

examination :—

1. Duration of rigor mortis to the sixth day in a body that had been handled, cut open, buried, again handled, carried fifteen miles on a charpoy in a damp tropical climate.
2. The skill that must have been used to give innumerable bruises all on the dorsum with a leather strap that never once coiled round
- 3.

with the other ventricles

VI.

EARLY FORMATION OF ADIPOCERE.

(Refer, p. 91.)

By Arthur Powell, M.B., M.S., Professor of Medical Jurisprudence, Bombay University, in *B.M.J.*, 1917.

tions, and in my own experience of many thousand autopsies adipocere was

heavy
fe died

of soft soap in the peritoneal cavity.

The heart, liver and kidneys were of a pale colour and felt soapy

and greasy. The pancreas looked and felt like soap, its outline well preserved.

Parts of the substance shaken up in water formed frothy "suds" at surface. Selected lumps almost completely dissolved in alcohol, leaving

inquest,

VII.

SHALLOW DROWNING.

(Refer, p. 232.)

a muscarriage, and had doubtless fainted while leaning over the bath.

Case (b).—The dead body of a young Hindu woman was found lying on a stretcher in one of the principal streets of Bombay.

On

disarrar

Interna

water.

evidenc.

left 22½ oz. The body was still warm and rigor mortis had not set in when found. The spleen weighed 17 oz. and contained ring and crescent malarial parasites. Heart and kidneys normal.

There was no doubt she had been drowned, but the question to be solved was, Why were the body and clothes dry? Some hours later

The husband explained that he and two friends were carrying the body, but finding the weight too much for them he and one of the friends went to get help. In the meantime the police arrived and began to raise an outcry which terrified the remaining friend so that he bolted.

No poison of any kind could be found in the body.

VIII.

HYMEN IN VIRGINITY AND DEFLOURATION.

(Refer, p. 262.)

thickness the frænum of the tongue, surrounding an opening either central or excentric. In the latter case, more commonly situated in the anterior than the posterior part of the membrane. When intact it is usually of a homogeneous colour, paler than the surrounding mucosa and free from visible blood vessels on its surface.

Its appearance in each case depends on—

1. Its consistence.
- 2 (a) The size.
- (b) The situation.
- (c) Number and
- (d) Shape of its aperture.

The opening is commonly central, circular or oval with its long axis antero-posterior.

Its margin is usually entire, but may have one or more notches, be crenato or even fimbriato in the virgin condition. In such cases the crenations are not nodular, and are of the same soft consistence as the rest of membrane.

A common variety is a crescentic fold parallel with the fourchette, stretched across the posterior wall of the vagina, its concavity looking forward, the horns of the crescent becoming lost on the anterior or lateral walls.

In rare cases it may be imperforate.

In a few cases the opening is double owing to the presence of a transverse or longitudinal bridle.

In other cases the openings may be numerous, producing the enbriform hymen.

In v
tion

the frænum linguae or even thinner, but it may be thick—even fleshy.

In a recent case of alleged rape on a child 11 years old, the hymen formed a thick, circular elastic ridge with smooth, rounded, entire margin

as thick as the web between her fingers, and, without stretching, admitted my index finger.

As the alleged rape took place ten days previous to my examination, all I could say was that I found no evidence of penetration, but that penetration might well have taken place without producing any tear.

The hymen after intercourse—When the aperture of the hymen is penetrated by the penis or other suitable foreign body its margins become torn in one or more places. The edges of the tears heal by granulation, and for five or six days a raw or granulating surface may be seen. After the lapse of eight or ten days cicatrization is complete. On each side of the tear small rounded nodules of scar tissue known as the caruncles remain.

The question, "Is the female examined a virgin?" is often put to the medical witness, and in few cases should he answer "Yes" or "No."

Apart from the finding of spermatozoa and evidence of disease or injury the answer should be either a description of the state of the hymen or "I found the conditions usual in virginity." "I found conditions usual in females who have had intercourse," or "The conditions found gave no evidence of sexual intercourse, but were such that intercourse may have taken place without leaving any evidence."

If the hymen be thin and fairly tense and the opening small, it is obvious no object as large as a penis can have penetrated.

If, on the other hand, the opening be large or the hymen be thick and elastic, or loose and flaccid, it is impossible to say from a physical examination that no penis has ever penetrated it.

If there be a laceration of the hymen the medical witness should say so, and add whether the laceration be recent or of old standing, i.e. its margins raw or cicatrized.

In a recent case where another surgeon had examined the victim he stated in his evidence, "The hymen was completely destroyed." I found

IX

HANKIN'S TEST FOR SEMINAL STAINS.

(Refer, p. 297)

In the hot dry climate of Upper India, seminal stains occasionally become so altered that it is impossible to remove spermatozoa from the fabric for examination by ordinary methods. It occurred to me that, in such cases, by subjecting the fabric to the solvent action of potassium cyanide, it might be possible to render the spermatozoa capable of removal. It was found that they could not withstand the cyanide unless they had been previously hardened by boiling in a tannin

The husband explained that he and two friends were carrying the body, but finding the weight too much for them he and one of the friends went to get help. In the meantime the police arrived and began to raise an outcry which terrified the remaining friend so that he bolted.

No poison of any kind could be found in the body.

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Page 262.

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The opening is commonly central, circular or oval with its long axis antero posterior.

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stretched
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walls.

In rare cases it may be imperforate.

In a few cases the opening is double owing to the presence of a transverse or longitudinal bridge.

In other cases the openings may be numerous, producing the cribriform hymen.

solution. The following are the details of the process. It must be understood that a less complicated procedure would probably be preferable in a damper climate.

(1) Cut out the suspected stains from the articles of clothing, etc. The cut-out pieces should be about a centimetre square. In the case of dhooties, the chances of success in detection are greatly increased if the supposed seminal stains have been marked by the police at the time of taking off the garment.

(2) Place the cut-out stains in a test-tube, and label the latter.

(3) Add sufficient acid tannin solution to cover the stains. This solution contains tannin 0.5 per cent., and sulphuric acid 0.2 per cent.

(4) Place the test-tube in a small beaker of boiling water. Keep it in the boiling water for exactly five minutes. In timing the different stages of this test, it is convenient to place a watch on the table and to make a mark on its glass with a glass pencil.

(5) Take the stains out of the test-tube. A piece of wire bent at the end to a small hook is convenient for the purpose. If the liquid in the test-tube remains transparent on cooling, it may safely be concluded that the stains are not seminal. If, as is more usually the case, the liquid becomes turbid on cooling, the stains may either be seminal or due to some other kind of organic matter.

(6) Place the stains on a piece of clean filter paper, and gently press them with another piece of filter paper to remove superfluous moisture. Fresh and clean filter paper must always of blotting

solution. This solution contains glycerine 5 per cent., and ammonia

str:

me

If

coloured background.

(8) Remove the stains and put them on filter paper.

(9) Transfer the stains to a small glass dish containing acid bichromate solution. Leave them in this solution for five minutes. This solution should contain one per thousand of potassium bichromate and two per thousand of sulphuric acid. This solution does not keep well, especially at a high temperature. Therefore, in the hot weather, it is advisable that it should be freshly made up. The action of the bichromate solution is to make the spermatozoa stain deeply when they are afterwards treated with carbol fuchsin.

some resemblance in outline to spermatozoa. The only safe rule for a beginner is that a positive diagnosis must not be made unless several spermatozoa are found. Spermatozoa are not recognizable as such for medicolegal purposes unless the heads are found in contact with the tails. Owing to decomposition the tails may often be greatly reduced in length, and in many individuals broken off. Really, when not visible with a low power, spermatozoa may be found with the help of an oil immersion lens. But in all cases in which spermatozoa are only found with difficulty there should be great hesitation in making a positive diagnosis.

The great majority of stains that are examined will fail to show spermatozoa. Spermatozoa are not likely to be detected in the following cases: (1) In films in which there is no sign of strongly stained organic matter, for instance, in specimens consisting almost entirely of dust or sand. (2) Spermatozoa are not likely to be found in preparations in which no epithelial scales are seen. (3) Spermatozoa are usually not recognizable if very numerous bacteria are present. Spermatozoa, at temperatures that obtain in India, may readily be rendered unrecognizable by decomposition. Decomposition for twenty-four hours is often more than sufficient to produce this change. In cases of assault coming under Section 376, I.P.C., the man usually runs away, thereby drying the stains on his dhoti, which therefore are protected from decomposition and remain recognizable. The woman's clothes, on the other hand, are liable to be wrapped up and sent for examination before the stains have had a chance of drying. This may be one of the reasons why, in practice, it rarely happens that spermatozoa are detected on a woman's clothes. The chance of detection of spermatozoa would be greatly increased if stains could be dried, at air temperature, as early as possible after their formation.

To search through ten to twenty slides for spermatozoa is somewhat tedious work. In my experience it is best done in the early morning. Later in the day, when the eye is tired, the process of recognition is less rapid and easy.

X.

LUNACY CERTIFICATE—FORMS.

SCHEDULE, INDIAN LUNACY ACT, 1912 (IV. OF 1912) \

(See section 96.) -

FORM 1.

Application for Reception Order.

(See sections 5 and 6)

In the matter of A. B.^[1], residing at , by occupation ,
 , son of
 a person alleged to be a lunatic

To Presidency Magistrate, for
 [or District Magistrate of
 , or Sub divisional Magistrate of
 or Magistrate specially empowered under Act IV of
 1912 for]-

The petition of C. D.^[1], residing at , by
 occupation , son of , in the
 town of [or sub-division of,
 in the district of]

1. I am ' [2] years of age
 2. I desire to obtain an order for the reception of A. B.
 as a lunatic in the asylum of
 situate at [3]

3. I last saw the said A. B. at on the
 [4] day of.

4. I am the [5] of the said A. B.
 [or if the petitioner is not a relative of the patient state
 as follows.]

I am not a relative of the said A. B. The reasons why
 this petition is not presented by a relative are as follows: [State
 them.]

The circumstances under which this petition is presented by me are
 as follows. [State them.]

Be at
 Law

the
 name, address, and description of the person in charge of the asylum.

[4] A day within 14 days before the date of the presentation of the petition
 is requisite.

[5] Here state the relationship with the patient.

5. The persons signing the medical certificate which accompany the petition are [1].

6. A statement of particulars relating to the said A. B. accompanies this petition.

7. [If that is the fact.] An application for an inquiry into the mental capacity of the said A. B. was made to the _____ on the _____ and a certified copy of the order made on the said petition is annexed hereto. [Or if that is the fact.]

No application for an inquiry into the mental capacity of the said A. B. has been made previous to this application.

The petitioner therefore prays that a reception order may be made in accordance with the foregoing statement.

(Sd.) C. D.

The statements contained or referred to in paragraph _____ are true to my knowledge, the other statements are true to my information and belief.

(Sd.) C. D.

Dated

Statement of particulars.

[If any of the particulars in this statement is not known, the fact to be so stated.]

The following is a statement of particulars relating to the said A. B.

Name of patient at length.

Sex and age

..

Supposed cause.

Whether the patient is subject to epilepsy.

Whether suicidal

Whether the patient is known to be suffering from phthisis or any form of tubercular disease.

Whether dangerous to others, and in what way.

Whether any near relative (stating the relationship) has been afflicted with insanity.

Whether the patient is addicted to alcohol, or the use of opium, ganja, charas, bhang, cocaine or other intoxicant.

[The statements contained or referred to in paras. _____ are true to my knowledge. The other statements are true to my information and belief]

[Signature by person making the statement.]

[1] Here state whether either of the persons signing the medical certificates is a relative, partner or assistant of the lunatic or of the petitioner and, if a relative of either, the exact relationship.

FORM 3.

Medical Certificate.

(See sections 18, 19.)

In the matter of A. B. of [1] in the town of [or
the sub-division of in the district of]
an alleged lunatic.

I, the undersigned C. D., do hereby certify as follows:

1 I am a gazetted medical officer [or a medical practitioner declared by Government to be medical officer under Act IV of 1912] [or declared by Local Government to be a medical practitioner under Act IV of 1912] and I am in the actual practice of the medical profession.

2. On the day of 19 at [2] in the town village of [or the sub-division of in the district of] [separately from any other practitioner] [3], I personally examined the said A. B. and came to the conclusion that the said A. B. is a lunatic and a proper person to be taken charge of and detained under care and treatment.

3. I formed this conclusion on the following grounds, viz. —

(a) Facts indicating insanity observed by myself, viz. —

(b) Other facts (if any) indicating insanity communicated to me by others, viz. — *Here state the information and from whom.*

(Sd) C. D.

(Designation as above.)

[1] Insert residence of patient

[2] Insert qualification to practise medicine and surgery registrable in the United Kingdom

[3] Insert place of examination

[4] Omit this where only one certificate is required

XI

LIFE ASSURANCE IN INDIA.

IN a relatively recent note on "Mortality and Life Assurance in India" read before the Institute of Actuaries in 1909 (*Proc.*, p. 8), Mr. A. T. Winter, F.I.A., writes

"Amongst European lives, the mortality is nearly as high in the first five years of assurance as in subsequent years," and then again, "during the first few years of residence in India, Europeans are more likely to become victims to enteric fever and similar diseases than subsequently, and as assurances are frequently effected when a man goes out of the country, this period of acclimatization is often concurrent with the first five

years of assurance. This, I think, explains to a large extent the heavy mortality of Europeans during that period." And on page 26, he writes: "The effect of selection on European mortality in India is not apparent, the mortality rates of the first five years of assurance being approximately the same as those ruling for lives of the same age which have been found insured for longer periods. This may, perhaps, be accounted for by the fact that the trying period of acclimatization is frequently concurrent with the first five years of assurance.

"The most eligible class of natives are assurable at the same rates as Europeans in India, provided their age entry does not exceed forty."

Concealments of Material Facts in Life Assurance. (See p 422)

Case (1)—J. A. R., insured in 1910, stated in reply to a written question that he never had syphilis. He died suddenly, aged 39, from cerebral hæmorrhage in 1915. It transpired that he had contracted

for syphilis. A fortnight before he was found hanging on a gallows outside the house of a man interested in the Assurance. He had obviously either fallen, jumped, or been thrown out of a second story

gist found the conditions I had in the left lung than I had found a ie Norwich Union was withdrawn.—

XII.

POISONING AND ANTIDOTES, SUMMARY.

D. e particular kind of poison is abstracted from Murrell's in Cases of Poisoning."

1. You will find the patient dead.—Prussic Acid, Cyanide of Potassium, Strong Ammonia, Carbonic Acid Gas,

Carbonic Oxide, Oxalic Acid and other active poisons given in a large dose.

2. **Patient is comatose.**—Opium and Morphine, Alcohol, Chloral, Chloroform, Camphor.
3. **Is collapsed.**—Strong Acids, Alkalis, Aconite, Antimony, Arsenic, Tobacco, Antipyrin, Antifebrin and last stage of most poisons.
4. **Is cyanosed.**—Aniline, Antifebrin.
5. **Is delirious.**—Cannabis Indica, Datura, Belladonna (noisy), Hyoscyami, Alcohol, Camphor.
6. **Is tetanized.**—Nux Vomica and Strychnine, Arsenic, Antimony, excessive pain also approaches this condition.
7. **Is paralysed.**—Aconite, Arsenic, Lead, Conium.
8. **Pupils dilated.**—Datura, Belladonna, and Hyoscyamus, in early stage, Opium and Aconite in last stage, Chloroform, Alcohol.
9. **Pupils contracted.**—Opium, Physostigmine, Chloral.
10. **Skin is dry.**—Datura, Belladonna, Hyoscyamus
11. **Skin is moist.**—Opium, Aconite, Antimony, Alcohol, Tobacco and other poisons in state of collapse.
12. **Mouth is bleached.**—Carbolic Acid, Corrosive Sublimate and Caustic Acids and Alkalis.
13. **Is vomiting.**—Arsenic (Brown with Blood), Antimony (White), Digitalis (Green), Aconite, Ammonia, Phosphorus, etc.

Antidotes for Commoner Poisons.

Abbreviations.

SP = Stomach pump

E = Emetic, preferably apomorphine $\frac{1}{10}$ gr. or common salt or mustard at once, followed by bitter emetic, ipecacuanha, zinc sulphate, etc.

D = Demulcents, milk, white of egg, barley water, olive oil, $\frac{1}{2}$ to 1 of water, flour paste.

St = Stimulants, *e.g.* brandy, ether, sal-volatile, hot water bottles to feet and arms.

UA = Universal antidote.¹

Poisons		Treatment and antidotes
Acids	Mineral acids, strong	Do not use SP or E, but neutralize by alkalis— <i>e.g.</i> chalk, scrapings from whitewashed wall, mortar, soda, soap and water, or UA. Then D.
	Oxalic acid	Opium or morphine, $\frac{1}{2}$ gr. for pain and shock. Do not use SP or E, but give lime, followed by castor oil
	Carbolic acid	Wash out stomach till washing ceases to smell. Then fill stomach with solution sulphate magnesia, $\frac{1}{2}$ oz. to pint. D and St. Artificial respiration if necessary.
	Hydrocyanic acid and cyanides	In open air, cold douche dashed over head and neck from height. SP or E. Sulphate of iron and liquor perchloride of iron. St and other hypodermically.
Alkalis	Caustic alkalis	
Metallic salts	Arsenic	SP or E Complete removal of contents is important UA, or ferric hydrate, or dialyzed iron, in frequently repeated tablespoonfuls, followed by a little salt in water as emetic. D and St. Ice for thirst. During recovery, mor-
	Antimony salts	
	Mercuric chloride	10 of egg mixed with milk and water. Then SP or E to get rid of precipitate. UA. Tincture of opium for pain or purging. St if depression
	Copper	If no vomiting, egg and milk before emptying stomach.
	Lead	
	Silver salts	

) Saturated solution of Ferrous parts, Charcoal 40, Water 100.
ng Murrell states that it is a
s and Acids, useful for Mercury.

Morphine and Strychnine, but of no use for Alkalis, Lead, Antimony or Hydrocyanic Acid.

Poisons.	Treatment and Antidotes.
Opium and mor- phine	SP, or in mild cases E Hot coffee. Potassium permanganate (see p 465) by mouth and for washing stomach, or charcoal. UA, especially
Aconite	SI St and warmth to extremities Keep recumbent position. Artificial respiration and friction. Strychnine $\frac{1}{3}$ gr.
Datura	SP or E Morphine ($\frac{1}{2}$ gr) or pilocarpine ($\frac{1}{2}$ gr). St and hot coffee Artificial respiration
Strychnine and nux vomica	SP or E Potassium bromide 2 drams, UA or tannin 30 grs iodine tincture $\frac{1}{2}$ dram in water, followed by E or SP. Chloroform inhalation in convulsions Artificial respiration.
Digitalis	SP or E UA, tannin or strong tea or coffee St and warmth Recumbent position and aconite
Alcohol (acute)	Ammonium carbonate 30 grs in water SP or E Rouse by cold affusion, battery, hot coffee Artificial respiration Warmth to extremities
Chloral and chloro- form	SP or E Strychnine, warmth, friction, and hot coffee St, ether hypodermically Artificial respiration
Anilina derivatives, antipyrine, anti febrin, phenace tin, pyrogallol	E, St Warm extremities Recumbent position. Strychnine $\frac{1}{3}$ gr. Artificial respiration
Cocaine	SP, St, and inhale ammonia, amyl nitrite Morphine. Artificial respiration
Croton oil	SP or E Wash out stomach with milk or sweet oil and water. D, St Opium or morphine for pain.
Fungi and food, poisonous	SP or E Purgatives. St any warmth. Opium or morphine for pain

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